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RAINFALL SIMULATION DATA SUMMARY

MONTANA - PRAIRIE POTHOLES

U.S. Department of the Interior
Bureau of Land Management
Division of Special Studies
Denver Federal Center
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INTRODUCTION

Field rainfall simulation studies were begun by the Bureau of Land Management in the summer of 1979 to provide BLM District Office staff with data to help evaluate the effects of Livestock Management Systems on infiltration and erosion. Plot studies were conducted at four field sites: Green Mountain (Wyoming), Prairie Potholes (Montana), Harcuvar Vulture (Arizona), and San Miguel (Colorado). The purpose of this report is to present the data collected from 14 plots on the Phillips-Elloam soil complex and 7 plots on the Dilts-Julin soil association at Prairie Potholes (Montana).

Precipitation, infiltration, runoff and suspended sediment data are presented graphically for individual simulated rainfall events on each plot. Total precipitation (P), total runoff (Q), Q/P ratio, total sediment yield, final infiltration (fc) and pre-run soil moisture are listed for individual runs. Soil series, range condition and vegetation data are listed for individual plots. Summary data are provided separately for all runs within the Phillips-Elloam complex and the Dilts-Julin association. Means and standard errors are calculated for P, Q/P, fc, and total sediment yield. Linear regression relationships are determined between final infiltration (fc) and total vegetative cover (vegetation, persistent and non-persistent litter) for dry (first) and wet (second) runs within a complex or association. While many variables affect the runoff response of individual plots, it was felt that total vegetative cover was the hydrologic variable most directly affected by livestock grazing. If describable, the fc versus total vegetative cover relationship was felt to be of fundamental interest to watershed managers.

METHODS

Twenty-one plots, approximately 2,500 ft^2 in area, were located at the Prairie Potholes site. Plots were selected in cooperation with Lewistown

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District Office personnel. To insure uniform sprinkler grid layouts among plots, a transit was used to locate the twenty-five sprinkler positions (Fig. 1). Each plot was equipped with a one-inch Parshall or a 0.4-ft HS flume, a Stevens stage height recorder, and twelve wedge-type raingages.

The rainfall simulator employed was patterned after one developed at Colorado State University (Holland, 1969) and modified by Lusby and Toy (1976). The simulator was designed to provide rainfall intensities of approximately 2 in./hr at 70 percent terminal raindrop velocity with variable raindrop size.

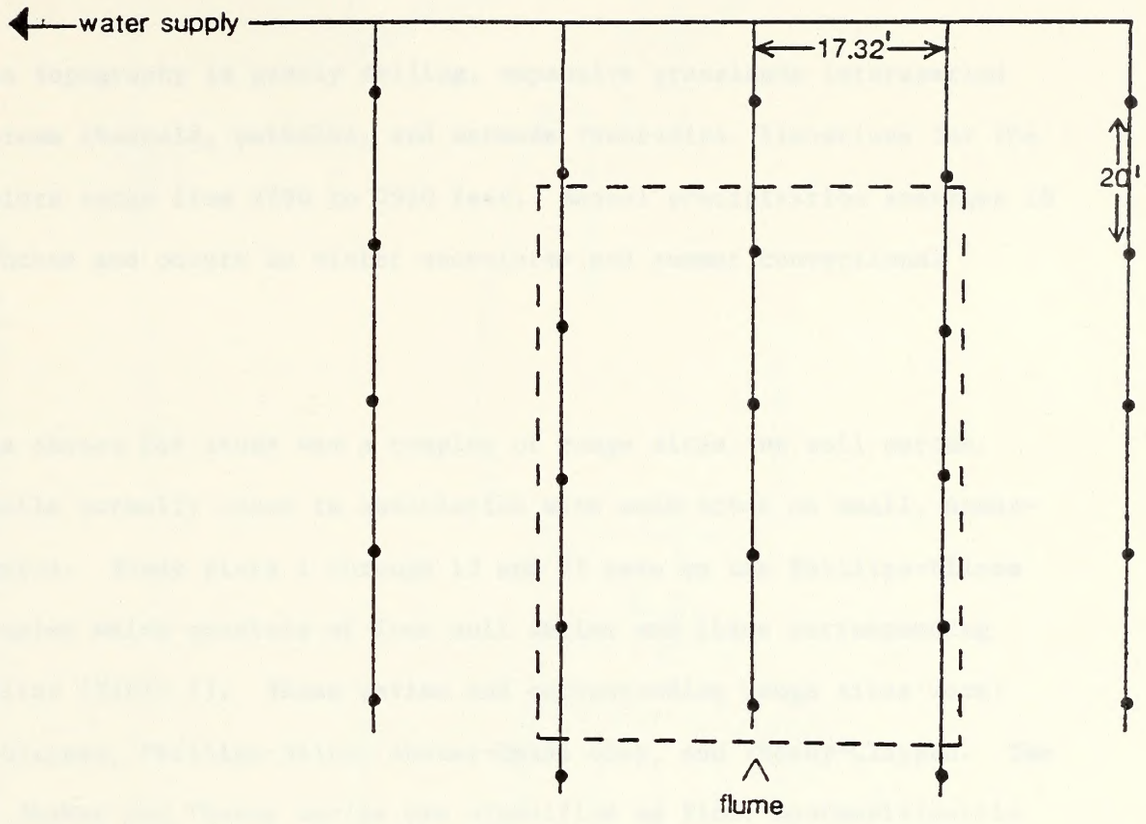
A minimum of two runs were conducted on each plot. A "wet" run generally followed a "dry" run by approximately one day. For each run, rainfall was applied at approximately 2 in./hr for 35-40 minutes. Times to ponding and runoff were recorded. Runoff was sampled at 1 to 2 minute intervals, increasing to 5 minute intervals during the latter part of the run. Laboratory analysis was performed on water samples for suspended sediment concentration.

Soil cores were taken at 2 to 4 locations and at 10 cm increments prior to each run, and were analyzed for water content.

Vegetative cover was sampled at 100 points along each of two transects on each rainfall simulation plot, using a 10-point frame (Neal et al., 1969). Canopy cover was calculated from first hit data in the canopy. Basal cover data was determined from subsequent basal hit data. Range condition was determined from plant species composition data for each plot using BLM Manual 4412 (1979).

Relative plot elevations were measured by transit and level rod. The data were used to construct plot contour maps by a computer program (USFS, 1975). The contour maps were used to compute plot area and weighted mean plot slope.

Figure 1. Sprinkler grid and plot layout for a simulation plot.



SITE DESCRIPTION

The study plots of the Prairie Potholes area were located on glaciated plains of northeastern Montana (Figure 2). The soils are derived from glacial till and/or the weathering of an underlying formation known as the Bear Paw Shale. Vegetation consists of cool season grasses and shrubs typical of the short grass prairie.

The area topography is gently rolling, expansive grasslands interspersed with stream channels, potholes, and manmade reservoirs. Elevations for the study plots range from 2290 to 2920 feet. Annual precipitation averages 10 to 14 inches and occurs as winter snowstorms and summer convectional storms.

The area chosen for study was a complex of range sites and soil series. These soils normally occur in association with each other on small, unmappable units. Study plots 1 through 13 and 21 were on the Phillips-Elloam soil complex which consists of four soil series and three corresponding range sites (Table 1). These series and corresponding range sites were: Elloam-Claypan, Phillips-Silty, Absher-Dense Clay, and Thoeny-Claypan. The Elloam, Absher and Thoeny series are classified as fine, montmorillonitic borollic natrargids. They are well drained with slow to very slow permeability and have slow to rapid runoff potential. The Phillips series is classified as a fine, montmorillonitic borollic paleargids. It is well drained with slow permeability and has slow to medium runoff potential. In general, Phillips soils are silty loams occurring on the tops of hummocks. Thoeny soils are similar to Phillips soils except that they have a sodium cap at a depth of 5 to 10 inches and occur on the flanks of hummocks. Elloam and Absher soils occur between hummocks. Absher soils have a thin surface crust underlain by dense clay. Elloam soils have a loamy surface texture underlain by a sodium cap at a depth of 1 to 4 inches. Vegetation on the Phillips-Elloam complex consists of short grasses and forbs.

Plots 14 through 20 were a Dilts-Julin soil association. Plot 18 was a Julin-Shallow Clay range site. Plots 14 through 17, 19, and 20 were on a Dilts-Shallow Clay range site. The Dilts and Julin series are classified

Figure 2. **Study Location Map 1**

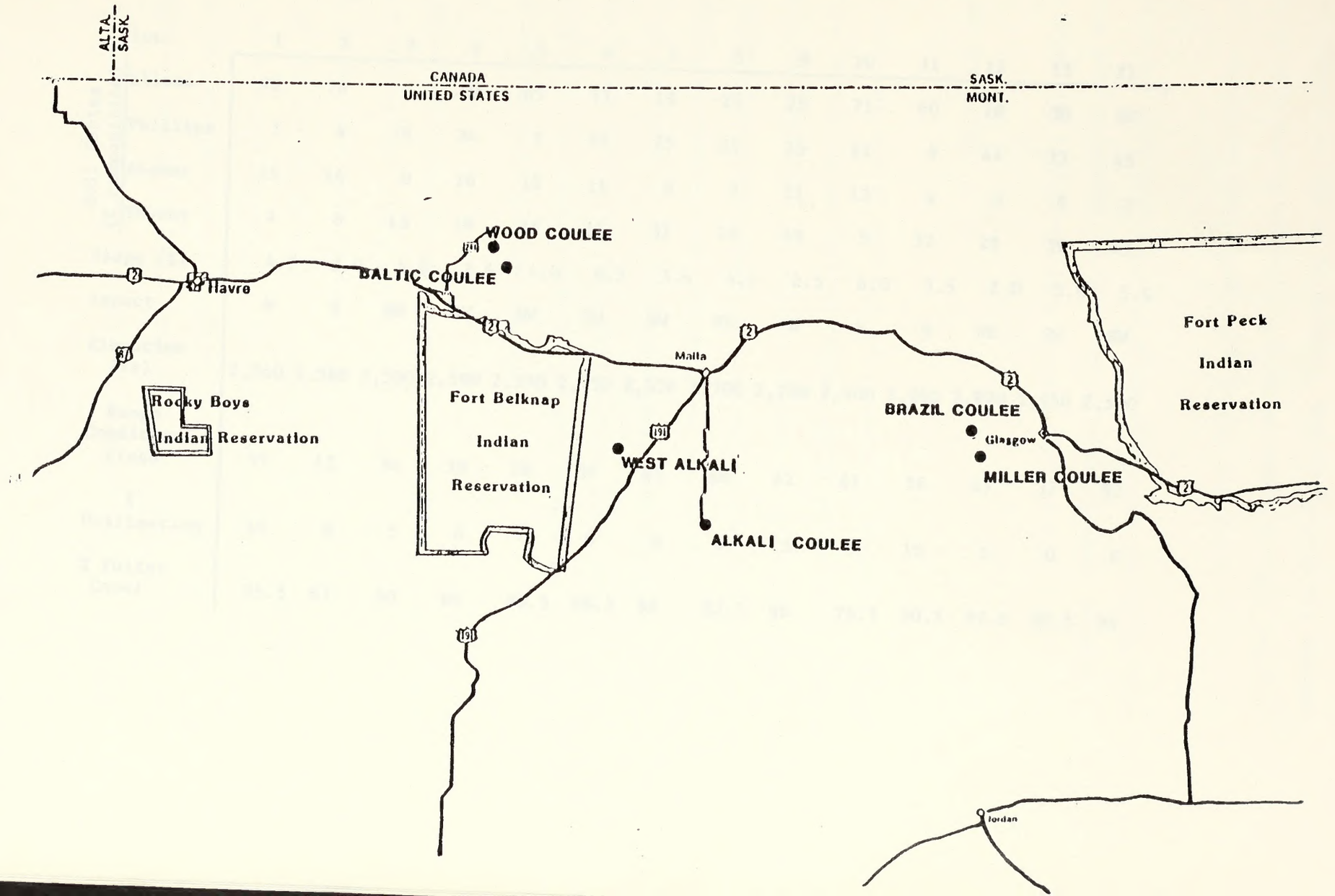


Table 1. Physical Characteristics of the Phillips-Elloam Complex.

Plot	1	2	3	4	5	6	7	8	9	10	11	12	13	21
Soil Series (% composition) Elloam	72	76	9	40	65	53	19	25	25	71	60	28	30	30
Phillips	3	4	78	24	2	25	25	22	15	11	4	44	23	45
Absher	21	14	0	18	18	11	9	7	11	13	4	0	8	2
Thoeny	4	6	13	18	15	11	32	46	49	5	32	28	39	23
Slope (%)	4.7	7.0	4.8	2.6	4.0	6.5	3.4	4.4	2.5	6.0	3.5	2.0	5.0	5.4
Aspect	N	S	NE	SW	NW	SW	NW	NE	N	S	W	NE	SW	SW
Elevation (ft)	2,560	2,560	2,500	2,580	2,590	2,550	2,550	2,700	2,700	2,900	2,860	2,920	2,950	2,500
Range Condition Class	59	43	36	39	28	39	61	58	42	67	56	65	37	92
% Utilization	10	0	5	0	0	0	0	5	5	5	15	0	0	0
% Foliar Cover	95.5	83	90	84	83.5	88.5	92	82.5	96	79.5	90.5	97.5	89.5	99

as clayey, montmorillonitic, acid, frigid, shallow usitc Torriorthents and ustic Torriorthents, respectively. Both soils are classified as clays and have clay contents as high as 50 percent. They are excessively drained, with slow to very slow permeability and having medium or rapid runoff potential. Vegetation consists of short grasses and juniper.

Range use in the study area consisted of six allotments, including three season-long grazing systems and three rest-rotation systems. Grazing characterisitcs for individual plots are summarized in Table 2.

RESULTS AND DISCUSSION

Data for individual runs on each plot are presented in Appendix I. Summary data for the 14 plots on the Phillips-Elloam complex and the seven plots on the Dilts-Julin association are provided in Table 3. Final infiltration rates on the Phillips-Elloam complex averaged 0.53 in./hr for the wet runs. Final infiltration rates were not reached on dry runs on this soil complex. Final infiltration rates on the Dilts-Julin complex averaged 0.93 in./hr and 0.53 in./hr for dry and wet runs, respectively. Thus, there was no difference in final infiltration rate for wet runs between the Dilts-Julin association and the Phillips-Elloam complex.

Average sediment yield from dry and wet runs on the Phillips-Elloam complex averaged 6.7 tons/mi^2 and 14.0 tons/mi^2, respectively. Average sediment yields on the Dilts-Julin association averaged 91.4 tons/mi^2 and 144.5 tons/mi^2 for dry and wet runs, respectively. The average sediment yields for wet runs were significantly ($\alpha < .000$) higher for the Dilts-Julin complex than the Phillips-Elloam association (Table 3). Sediment yield data are dependent on many rainfall, soil, slope, plot size, and cover variables, and thus should only be considered as an index for a particular site.

A significant linear relationship ($\alpha < .05$) was found between final infiltration rate (fc) and total vegetative cover for dry runs on the Phillips-Elloam complex (Fig. 3). The relationship was not significant for wet runs on either the Phillips-Elloam complex (Fig. 3) or the Dilts-Julin association (Fig. 4).

Table 2. Physical and Grazing Characteristics for Studied Allotments and Pastures for 1979.[1]

Allotment	Plot	Dates pastures studied	Pasture (acre size)	Pasture stocking density (ac/AUM)	Grazing system	Grazing season treatment[2]	Approximate grazing schedule (1979)[3]	
West Alkali	1, 2	June 10-13	3,997	5.2	Rest rotation	Spring	500 200	5/6-6/5 6/6-8/1
West Alkali	3	June 15-16	4,390	5.5	Rest rotation	Summer	450 680	6/6-7/30 8/1-9/1
West Alkali	4, 5	July 11-15	2,297	5.1	Rest rotation	Rest	280 630	8/1-10/14 10/15-10/25
Alkali Coulee	6, 7	July 16-19	1,931	4.7	Season-long	Season-long	58	5/1-11/30
Baldik	8, 9	July 21-24	11,513	7.3	Season-long	Season-long	251 251	4/16-10/15 11/10-11/20
Wood Coulee (Unit 6)	10, 11	August 22-26	933	5.2	Rest rotation	Summer	178	7/18-9/2
Wood Coulee (Unit 6)	12, 13	August 27-29	1,067	5.6	Rest rotation	Rest	179 53	9/2-9/26 9/26-10/15
Miller Coulee	14, 15	September 20-22	7,034	10.0	Rest rotation	Rest	REST	
	16, 17	September 24-26	6,090	9.9	Rest rotation	Spring	189 159	4/10-6/15 5/10-6/15
Brazil Creek	18, 19	October 17-21	31,862	7.4	Season-long	Season-long	519 819 46	5/1-7/1 7/1-10/31 10/31-11/15

[1]Cattle was the livestock class for all allotments studied.
[2]Several rest treatment pastures were actually grazed after the pastures were sampled. These pastures had been rested in 1978; therefore they were considered as rest treatments.
[3]Numbers are for head of cattle.

Table 3. Means, standard errors, n-values and significance of differences between hydrologic values for dry and wet runs on Phillips-Elloam soil complex and Dilts-Julin soil association.

Soil	Statistics	Run	Precipitation mean	Precipitation s.e.	Precipitation n	Q/P mean	Q/P s.e.	Q/P n	Final Infiltration mean	Final Infiltration s.e.	Final Infiltration n	Sediment Yield mean	Sediment Yield s.e.	Sediment Yield n
Phillips-Elloam complex	Mean, se, n	dry	1.48	0.04	14	0.09	0.02	14	1.35	0.27	3	6.74	2.88	11
		wet	1.59	0.06	14	0.24	0.04	14	0.53	0.11	13	13.98	3.30	13
	T-value of difference between runs		-1.55			-3.40			3.21			-1.63		
	Significance level of T-value		0.13			0.00			0.01			0.12		
Dilts-Julin association	Mean, se, n	dry	1.59	0.02	7	0.27	0.07	7	0.93	0.17	6	91.43	29.39	7
		wet	1.63	0.05	7	0.22	0.07	7	0.53	0.14	7	144.46	39.79	7
	T-value of difference between runs		-0.66			0.05			1.89			-1.07		
	Significance level of T-value		0.52			0.63			0.09			0.31		
both	F-value of difference between soils	both	2.10			2.91			0.71			33.40		
	Significance level of F-value		0.16			0.10			0.41			0.00		

The relationships presented should not be extrapolated for general planning purposes. Other variables, including local differences in soils (including compaction), vegetative composition, and micro-relief also affect infiltration. In addition, there was not a uniform distribution of percent cover within the range of cover conditions tested. This could result in a spurious regression fit. Finally, a number of factors can affect the accuracy and replicability of the experimental technique, including wind and equipment performance.

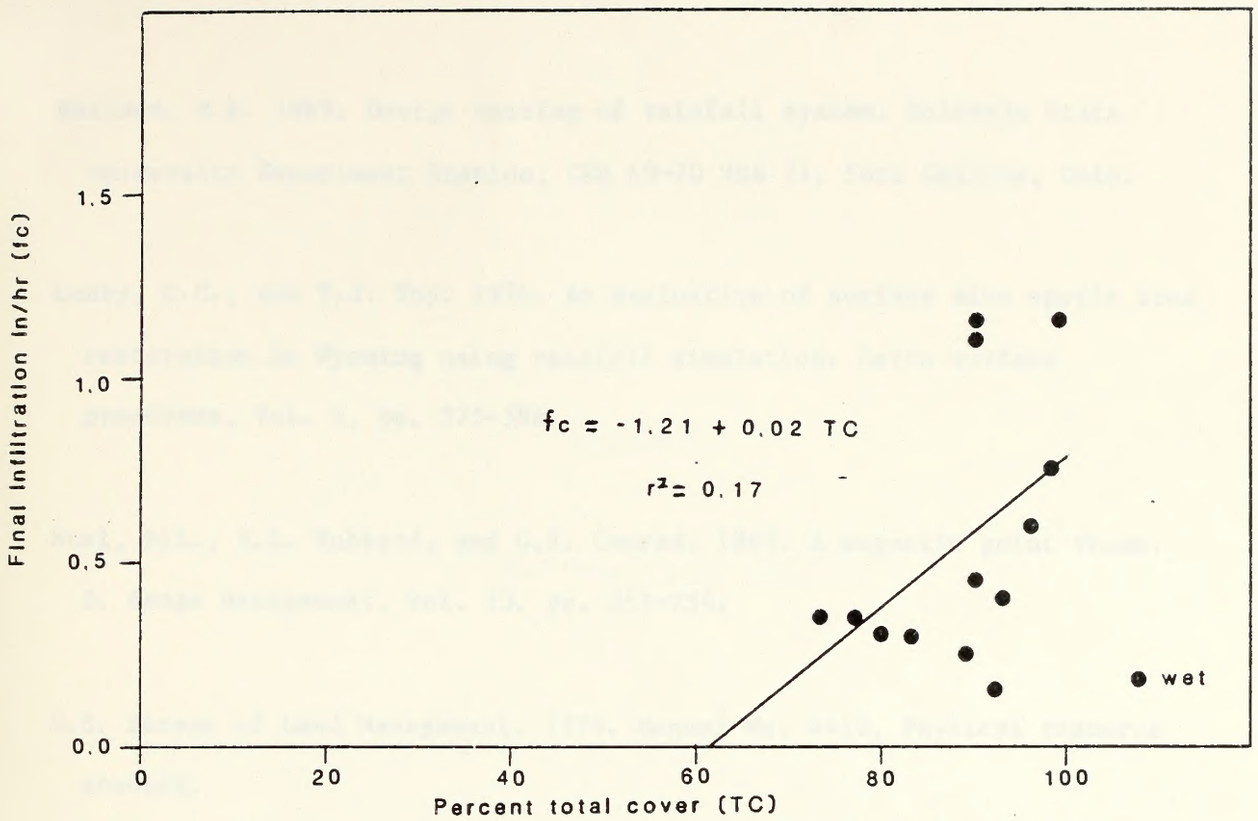


Figure 3. Final infiltration versus percent total cover for Phillips-Elloam soil complex

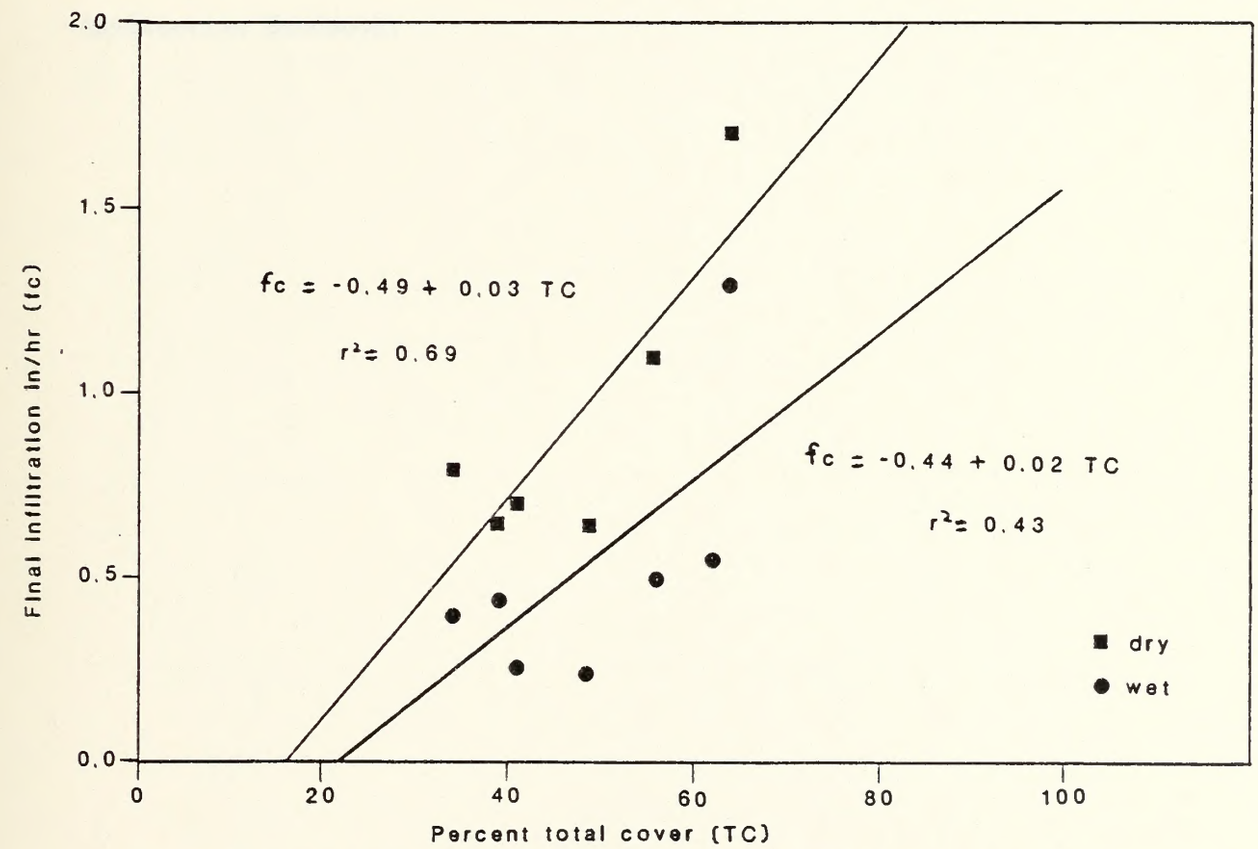


Figure 4. Final infiltration versus percent total cover for Dilts-Julin soil association

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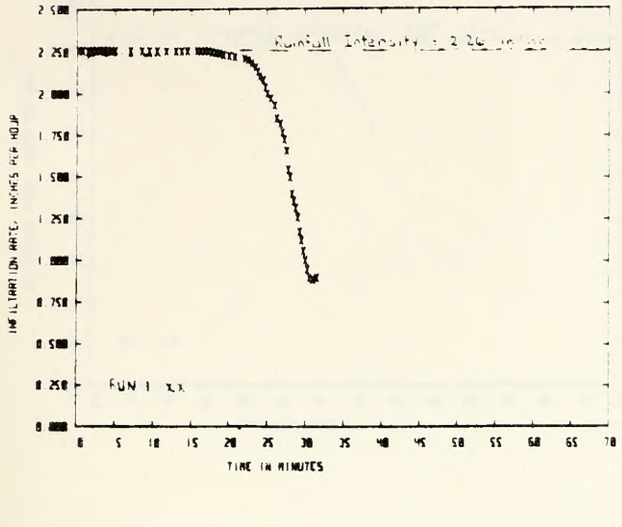
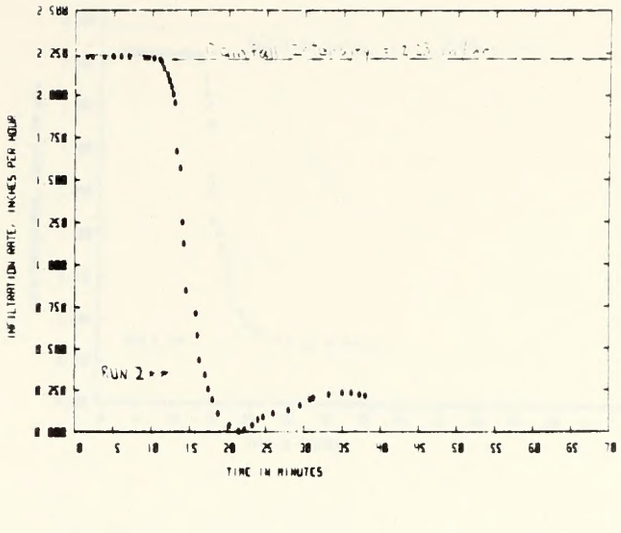
APPENDIX I

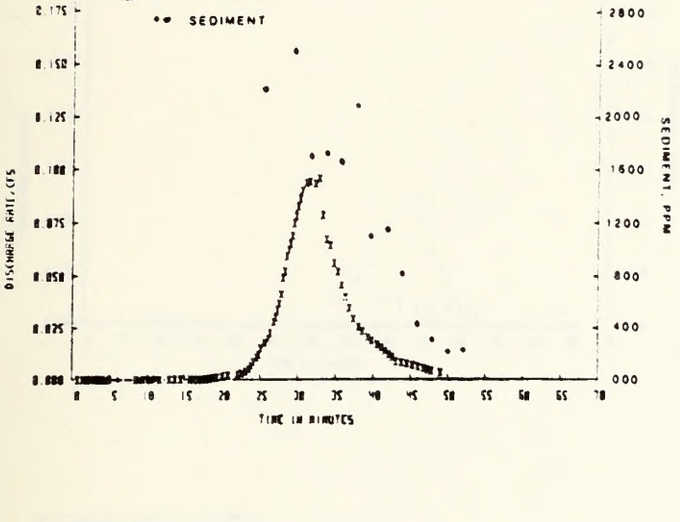
Individual Plot Data

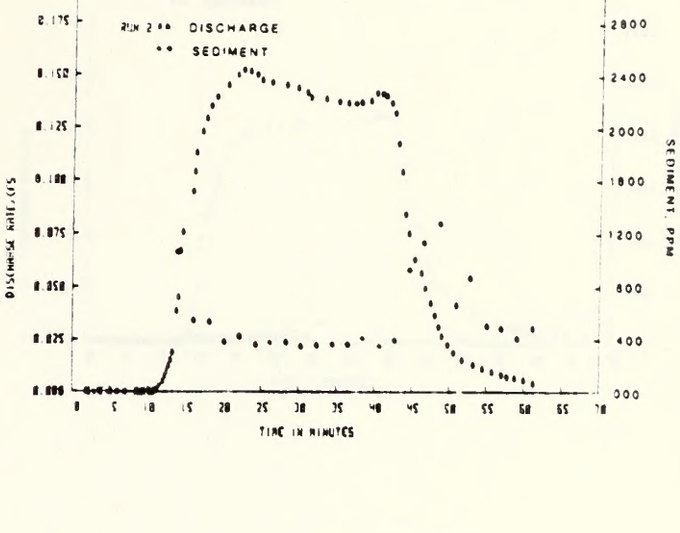
Montana Prairie Potholes Plot Number 1 Plot Size = 2962 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	6/10/79	0.15	1.20	0.13	25.6	--	12.6
wet (2)	6/11/79	0.09	1.42	0.06	32.0	0.15	21.8

SOILS AND VEGETATION

Range Condition	% Slope
59	4.7

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
72	3	21	4

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	30.5	52.0
Bare	8.5	4.5
NP Litter	36.5	30.0
Per Litter	18.0	9.5
Gravel	5.5	3.0
Cobble	1.0	1.0

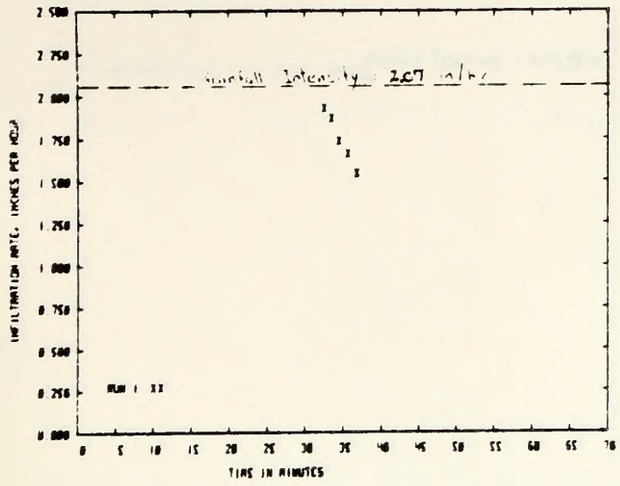
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Bouteloua gracilis	5.5	11.0
Atriplex numalaria	0.5	1.0
Phlox	3.5	3.0
Poa secunda	1.5	2.0
Koeleria cristata	3.0	5.0
Opuntia	0.5	6.5
Selaginella	11.0	1.0
Agropyron smithii	2.0	9.5
Vicia americana	1.5	7.0
Arenaria franklinii	1.0	2.0
All others	0.5	4.0

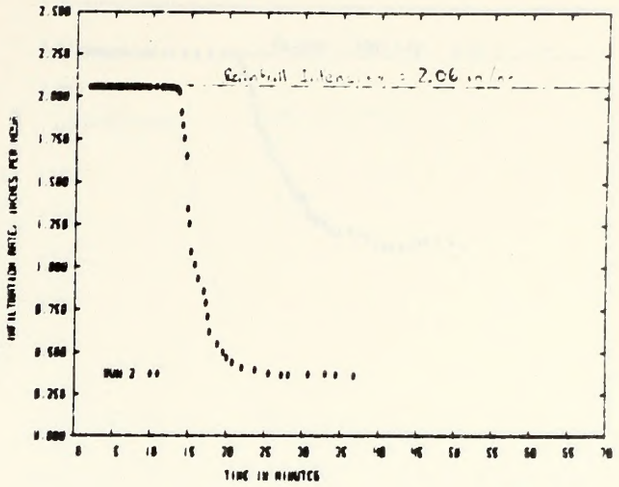
* Determined from first hit data using a point frame.

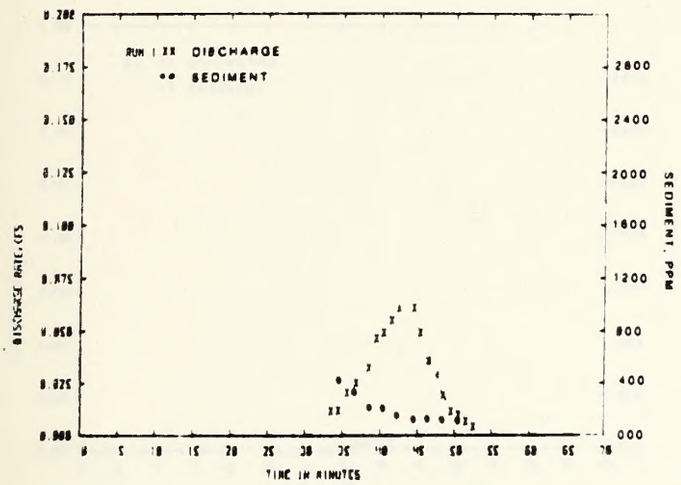
Montana Prairie Potholes Plot Number 2 Plot Size = 2678 ft^2

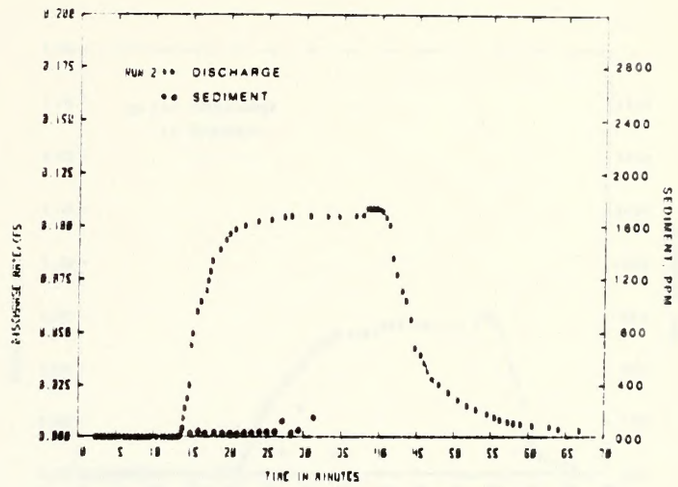
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	6/12/79	0.10	1.28	0.08	1.9	--	8.7
wet (2)	6/13/79	0.14	1.28	0.11	6.4	0.35	24.4

SOILS AND VEGETATION

Range Condition	% Slope
43	7.0

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
76	4	14	6

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	33.0	49.0
Bare	23.0	17.0
NP Litter	11.5	12.0
Per Litter	24.0	16.0
Gravel	8.5	6.0

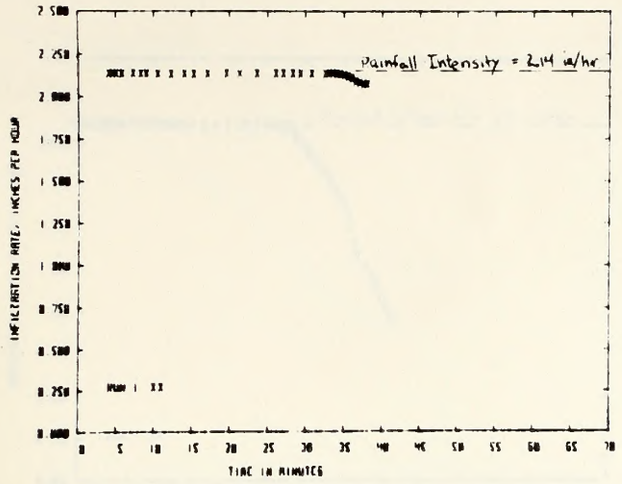
Species Composition

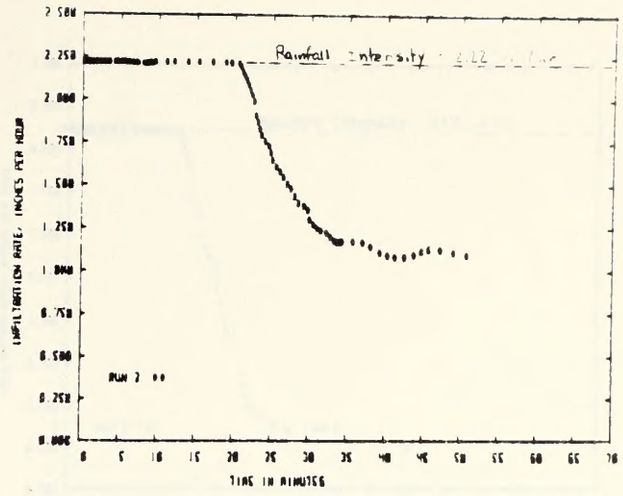
Species	% of Basal Cover	% of Canopy* Cover
Bouteloua gracilis	12.5	22.0
Selaginella	10.5	9.5
Moss	2.5	1.0
Koeleria cristata	1.0	1.0
Carex	1.5	2.5
Phlox	1.0	1.0
Ratibida columnifera	0.5	1.0
Festuca octoflora	1.0	0.5
Agropyron smithii	1.0	5.5
Poa secunda	1.0	2.5
All others	0.5	2.5

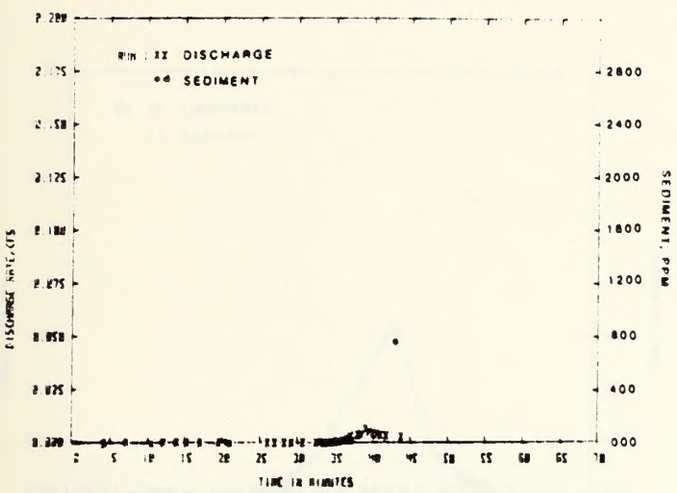
* Determined from first hit data using a point frame.

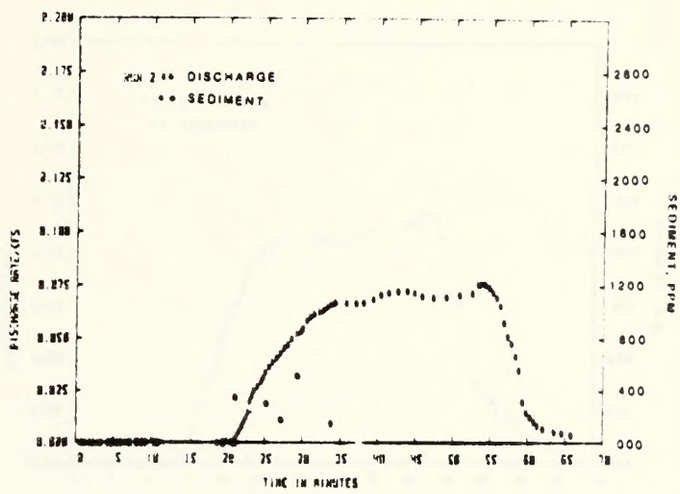
Montana Prairie Potholes Plot Number 3 Plot Size = 275i ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	6/15/79	0.00	1.36	0.00	--	--	3.5
wet (2)	6/16/79	0.46	1.90	0.24	1.9	1.10	19.6

SOILS AND VEGETATION

Range Condition	% Slope
36	4.8

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
9	78	0	13

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	30.0	43.5
Bare	11.0	10.0
NP Litter	32.5	27.5
Per Litter	26.5	19.0
Gravel	0.0	0.0

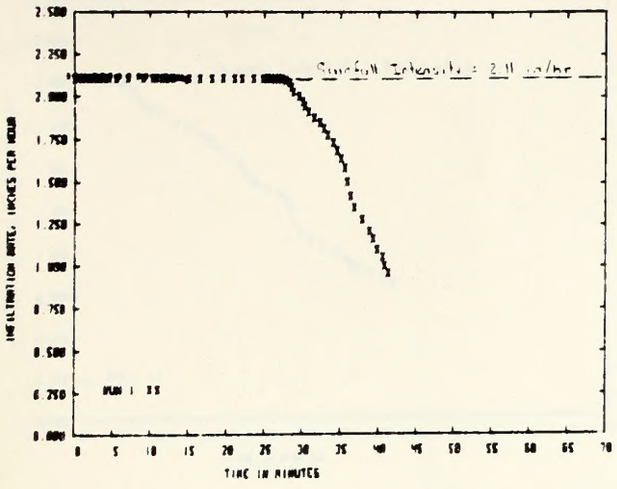
Species Composition

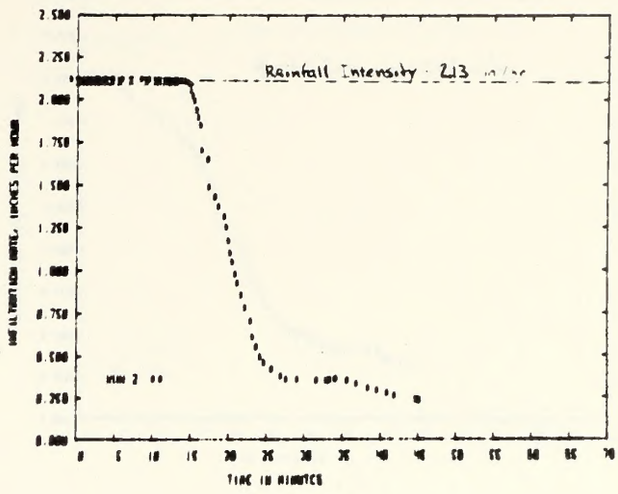
Species	% of Basal Cover	% of Canopy* Cover
Selaginella	7.5	6.5
Bouteloua gracilis	6.0	10.0
Stipa comata	1.5	4.0
Koeleria cristata	7.5	13.5
Sphaeralcea coccinea	0.5	0.5
Arenaria	1.5	3.0
Lichen	2.0	1.0
Poa secunda	1.0	1.5
Plantago	0.5	0.5
Phlox	0.5	0.5
All others	1.5	2.5

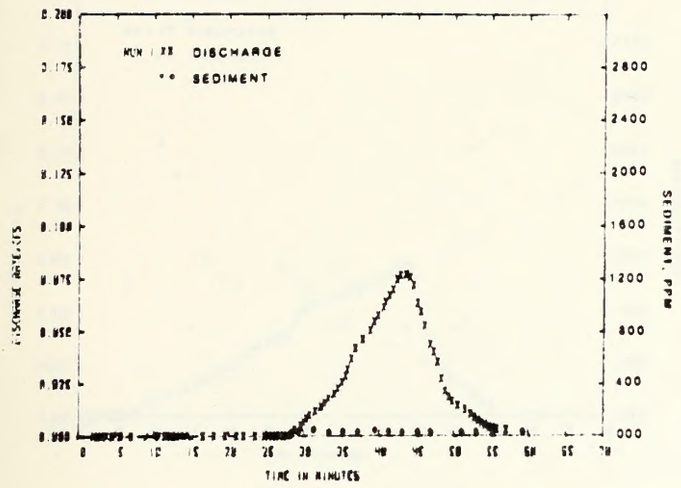
* Determined from first hit data using a point frame.

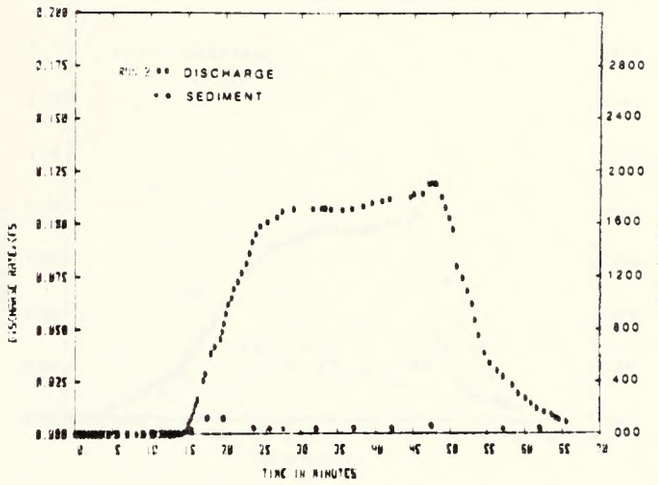
Montana Prairie Potholes Plot Number 4 Plot Size = 2619 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	7/11/79	0.16	1.46	0.11	1.9	--	5.5
wet (2)	7/12/79	0.18	1.60	0.11	1.9	0.30	21.0

SOILS AND VEGETATION

Range Condition	% Slope
39	2.6

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
40	24	18	18

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	47.0	57.0
Bare	18.0	16.0
NP Litter	6.5	5.0
Per Litter	27.5	21.0
Gravel	1.0	1.0

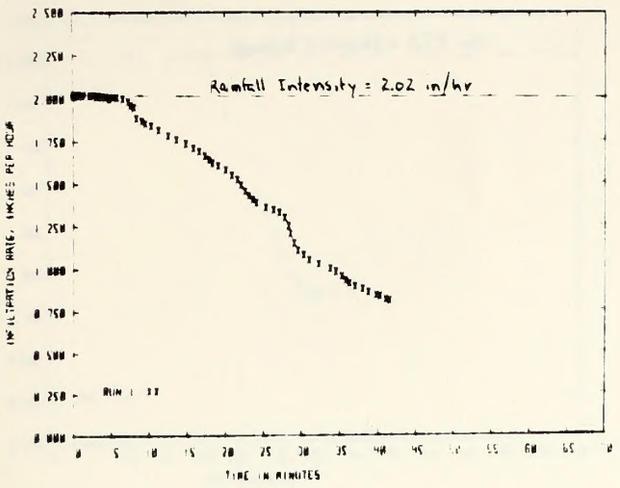
Species Composition

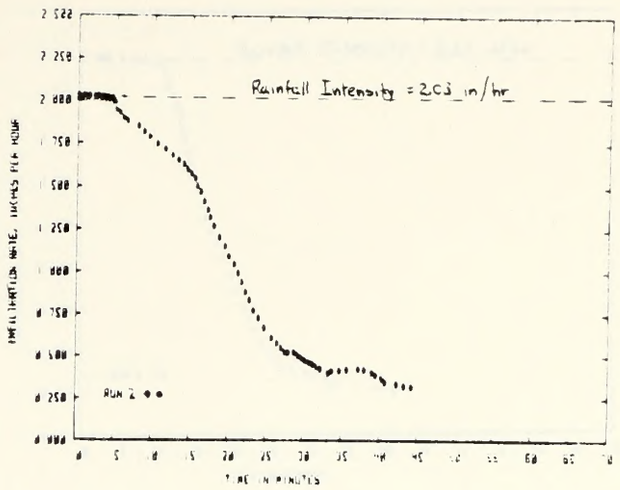
Species	% of Basal Cover	% of Canopy* Cover
Schedonnardus paniculatus	1.0	1.0
Selaginella	12.0	9.0
Bouteloua gracilis	19.5	21.5
Arenaria	1.5	1.5
Poa secunda	2.0	3.0
Opuntia	0.5	0.5
Atriplex nuttallii	1.0	1.5
Carex	2.0	2.0
Acacia latifolia	0.5	4.0
Plantago	1.0	0.5
All others	6.0	12.5

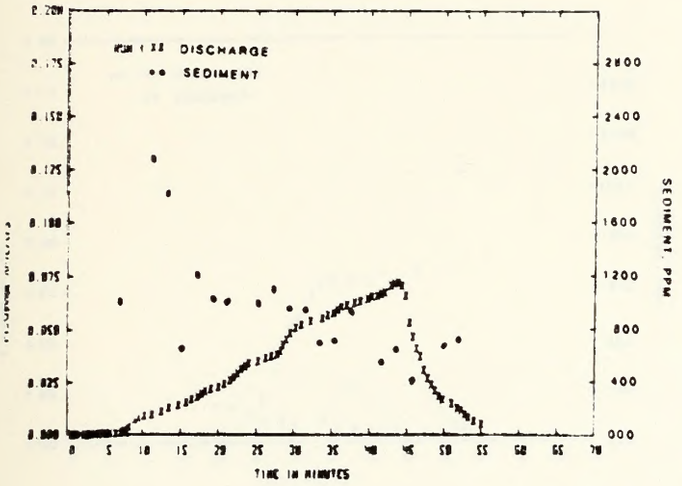
* Determined from first hit data using a point frame.

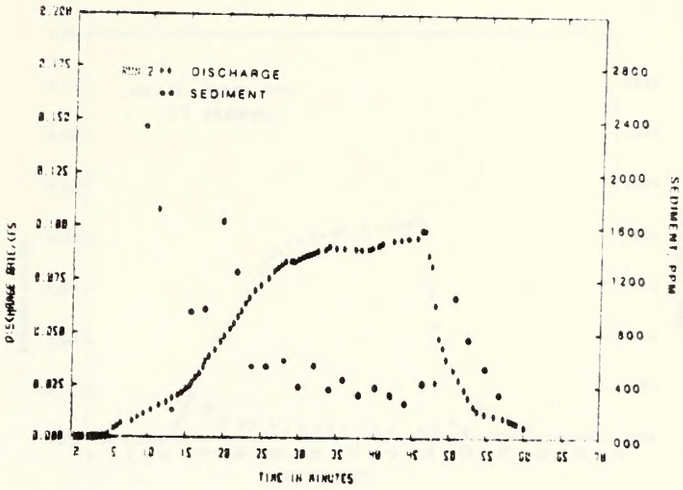
Montana Prairie Potholes Plot Number 5 Plot Size = 2405 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	7/14/79	0.31	1.40	0.22	25.6	--	11.2
wet (2)	7/15/79	0.69	1.50	0.46	32.0	0.35	18.2

SOILS AND VEGETATION

Range Condition	% Slope
28	4.0

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
65	2	18	15

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	28.5	36.0
Bare	16.5	16.5
NP Litter	5.5	2.5
Per Litter	38.5	34.0
Gravel	11.0	11.0

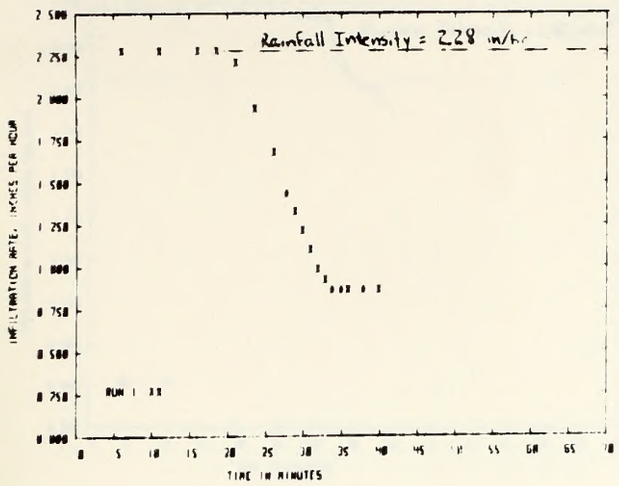
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Selaginella	8.5	8.0
Bouteloua gracilis	12.5	16.0
Poa secunda	4.0	5.5
Plantago	0.5	0.5
Carex	0.5	1.0
Opuntia	0.5	0.5
Koeleria cristata	0.5	0.5
Arenaria franklinii	1.5	3.0
Sitanion hystrix	0.0	0.5
Stipa comata	0.0	0.5

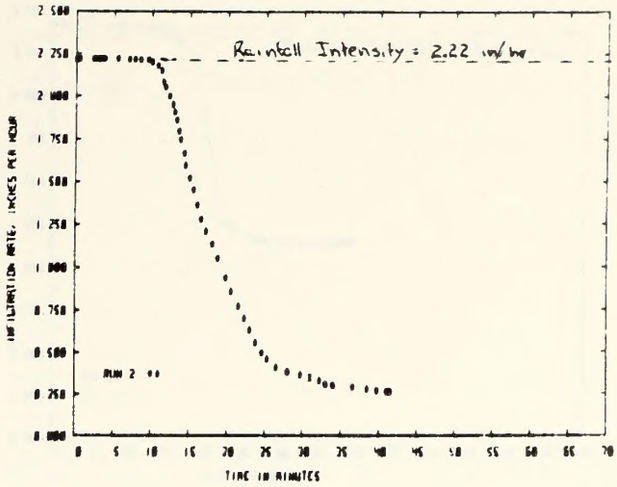
* Determined from first hit data using a point frame.

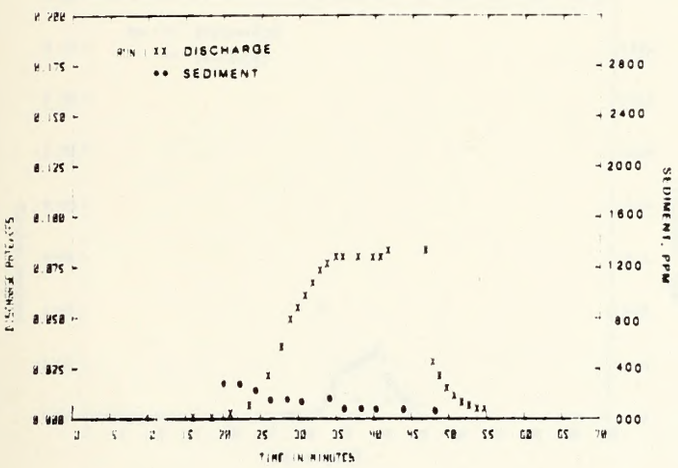
Montana Prairie Potholes Plot Number 6 Plot Size = 2351 ft^2

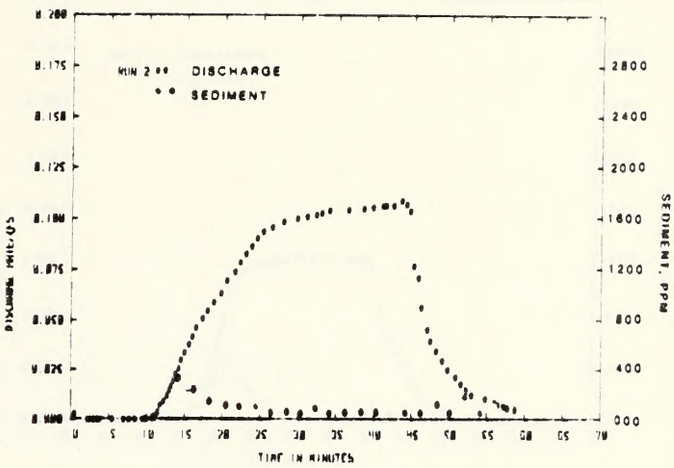
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	7/16/79	0.35	1.55	0.23	6.4	0.85	2.2
wet (2)	7/17/79	0.26	1.55	0.17	6.4	0.25	15.5

SOILS AND VEGETATION

Range Condition	% Slope
39	6.5

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
53	25	11	11

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	38.5	57.5
Bare	14.5	11.5
NP Litter	18.0	12.0
Per Litter	29.0	19.0
Gravel	0.0	0.0

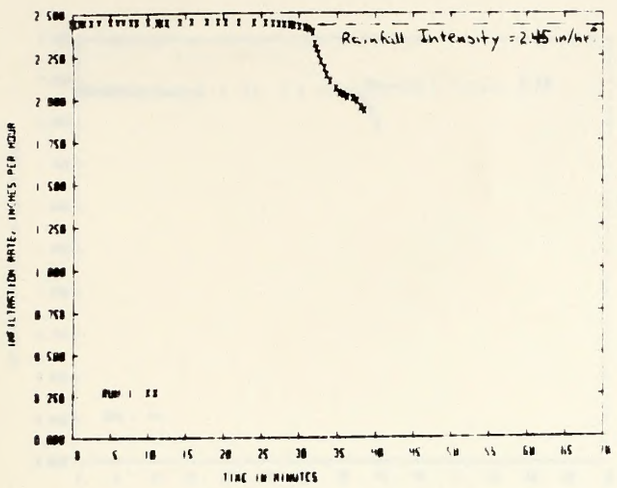
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Sphaeralcea coccinea	0.5	1.0
Bouteloua gracilis	17.5	21.0
Agropyron smithii	1.5	1.5
Koeleria cristata	1.0	0.5
Selaginella	6.0	4.5
Sitanion hystrix	0.5	0.5
Opuntia	1.0	3.5
Poa secunda	4.5	6.0
Festuca octoflora	3.5	8.5
Plantago	2.0	5.5
All others	0.5	5.0

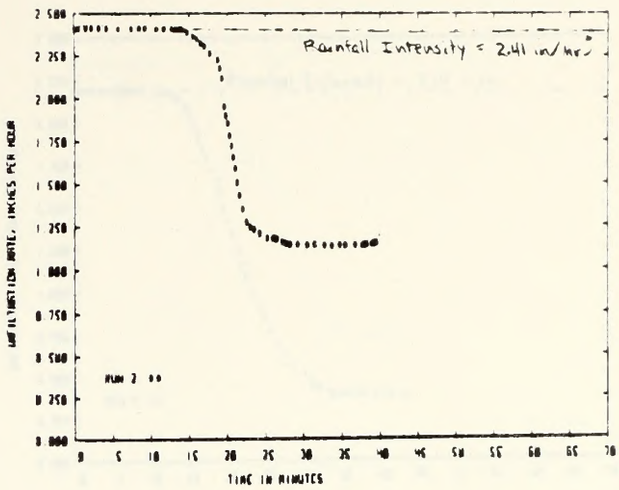
* Determined from first hit data using a point frame.

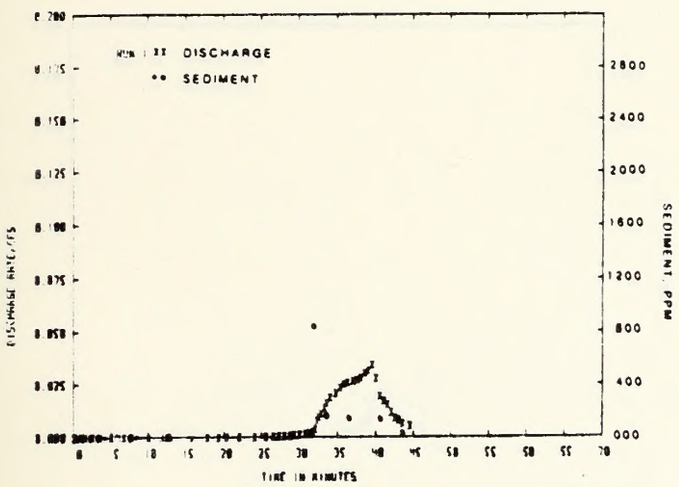
Montana Prairie Potholes Plot Number 7 Plot Size = 2615 ft^2

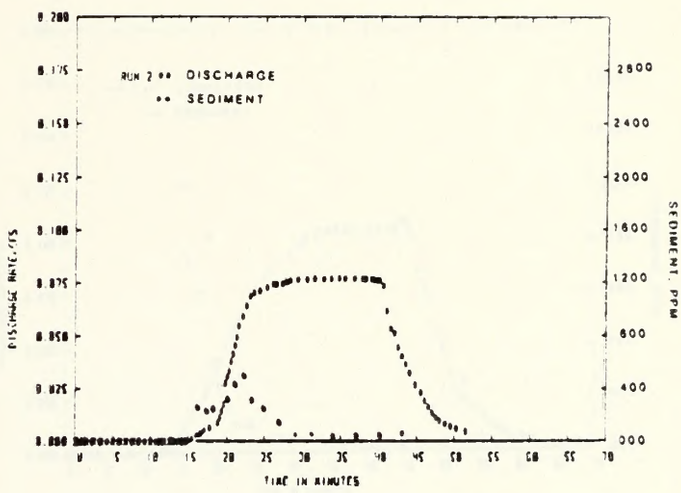
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	7/18/79	0.03	1.57	0.02	0.6	--	3.9
wet (2)	7/19/79	0.37	1.65	0.22	6.4	1.15	17.4

SOILS AND VEGETATION

Range Condition	% Slope
61	3.4

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
19	25	9	32

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	38.4	58.4
Bare	9.5	7.9
NP Litter	15.8	10.0
Per Litter	33.7	21.1
Gravel	2.6	2.6

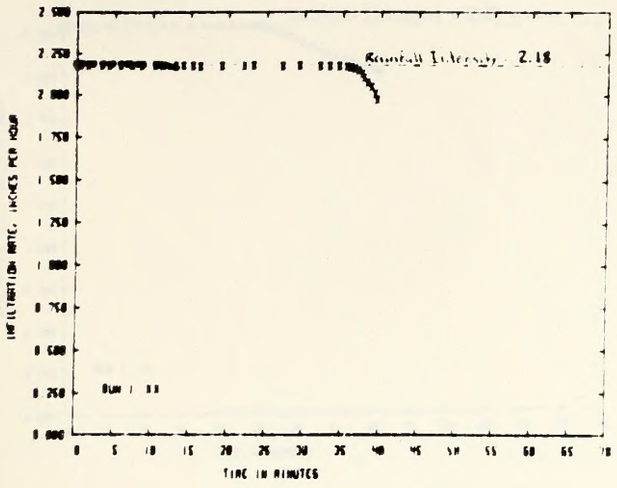
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Poa secunda	2.6	2.1
Bouteloua gracilis	10.5	13.1
Agropyron smithii	2.1	4.7
Opuntia	0.5	0.5
Selaginella	9.0	7.9
Schedonnardus paniculatus	0.5	1.6
Stipa comata	3.7	5.3
Arenaria franklinii	0.5	2.1
Koeleria cristata	4.7	6.3
Carex	1.0	3.1
All others	3.0	11.6

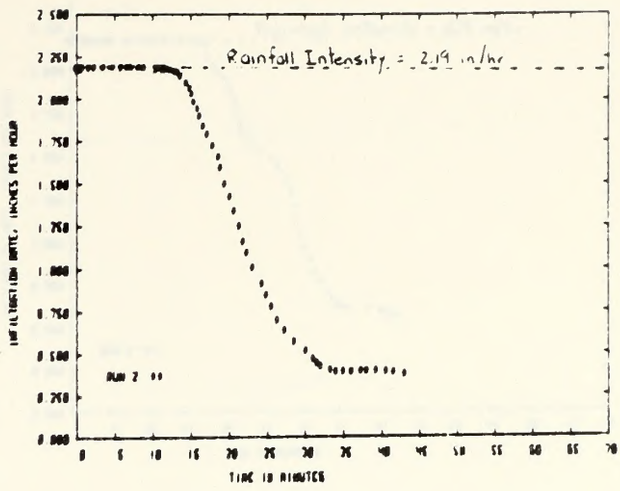
* Determined from first hit data using a point frame.

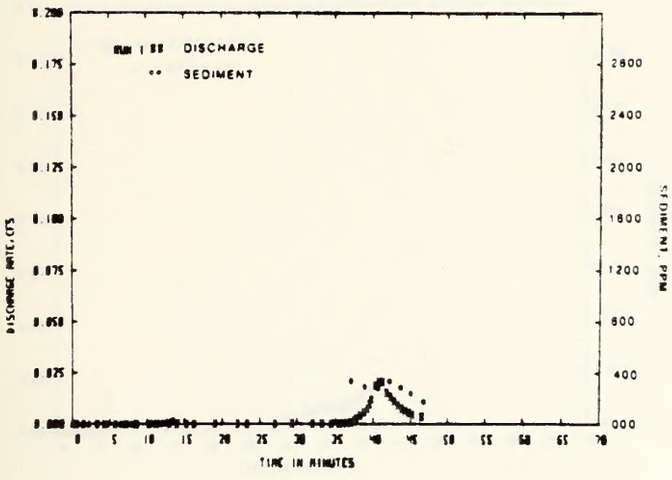
Montana Prairie Potholes Plot Number 8 Plot Size = 2508 ft^2

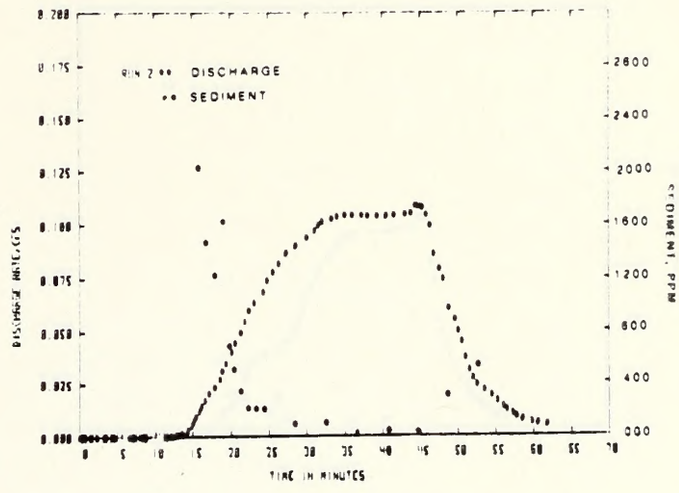
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	7/21/79	0.01	1.44	0.01	0.6	--	4.7
wet (2)	7/22/79	0.26	1.57	0.17	25.6	0.40	27.2

SOILS AND VEGETATION

Range Condition	% Slope
58	4.4

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
25	22	7	46

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	45.0	64.0
Bare	11.5	7.5
NP Litter	9.5	5.5
Per Litter	34.0	23.0
Gravel	0.0	0.0

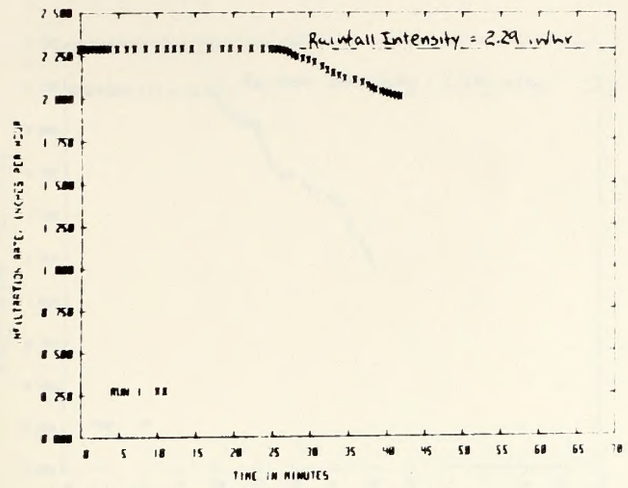
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Bouteloua gracilis	23.0	23.5
Koeleria cristata	4.0	6.0
Phlox	1.5	1.0
Carex	2.5	1.0
Agropyron smithii	1.0	9.0
Selaginella	7.5	6.5
Plantago	1.0	1.5
Stipa comata	1.0	8.0
Opuntia	0.5	0.5
Arenaria franklinii	1.0	2.0
All others	2.0	5.0

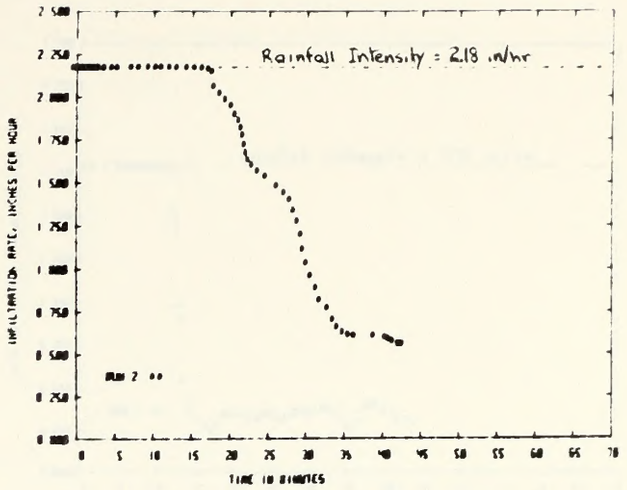
* Determined from first hit data using a point frame.

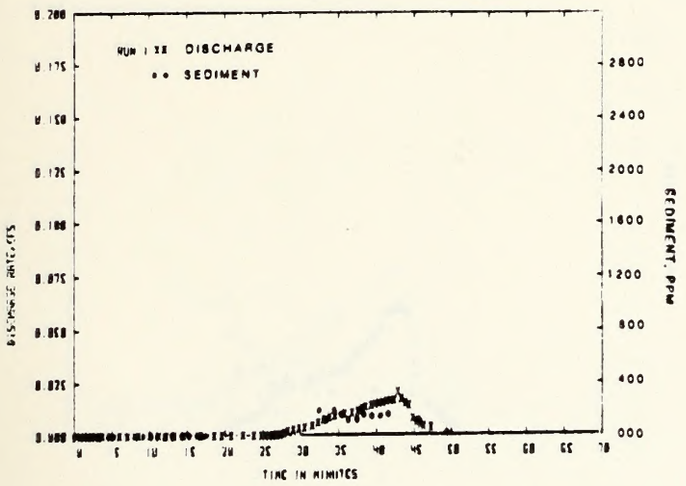
Montana Prairie Potholes Plot Number 9 Plot Size = 2567 ft^2

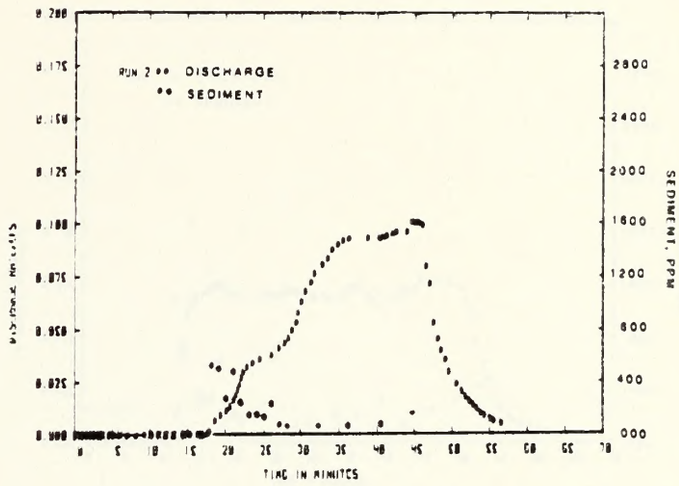
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	7/23/79	0.02	1.60	0.01	1.9	--	8.1
wet (2)	7/24/79	0.37	1.56	0.24	2.6	0.60	24.3

SOILS AND VEGETATION

Range Condition	% Slope
42	2.5

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
25	15	11	49

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	46.0	67.0
Bare	10.0	4.0
NP Litter	15.0	9.5
Per Litter	29.0	19.5
Gravel	0.0	0.0

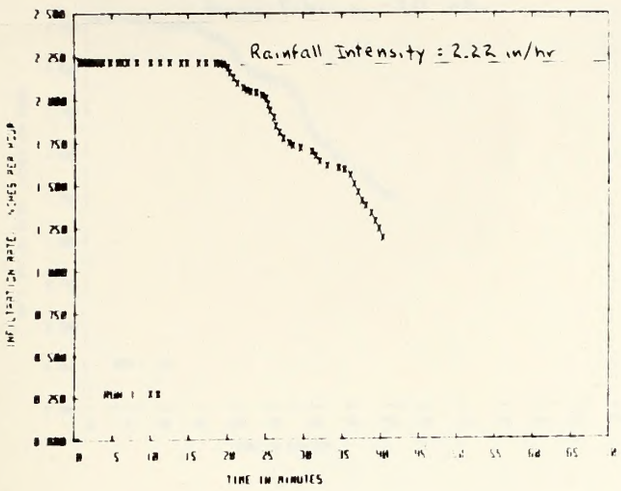
Species Composition

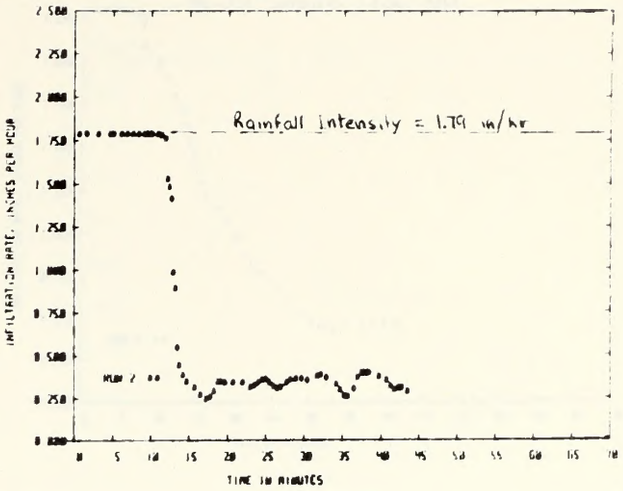
Species	% of Basal Cover	% of Canopy* Cover
Bouteloua gracilis	23.5	32.5
Selaginella	9.5	8.0
Poa secunda	2.0	6.5
Stipa comata	0.5	2.0
Koeleria cristata	3.5	6.0
Agropyron smithii	2.5	6.0
Carex	0.5	0.5
Phlox	1.0	0.5
Moss	1.0	1.0
Plantago	0.5	1.5
All others	1.5	2.5

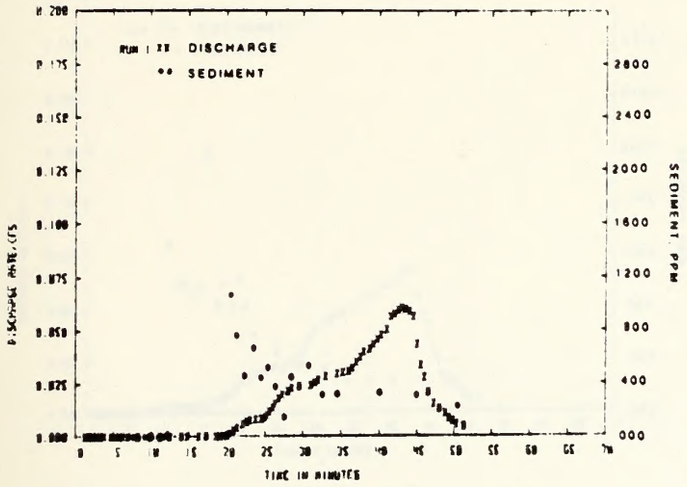
* Determined from first hit data using a point frame.

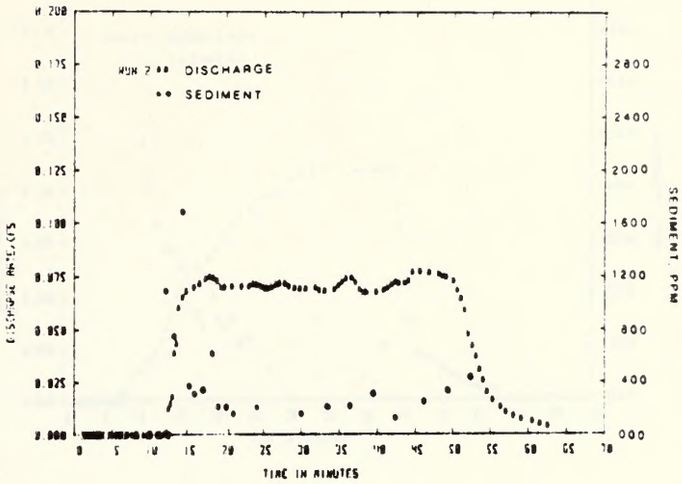
Montana Prairie Potholes Plot Number 10 Plot Size = 2107 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	8/22/79	0.16	1.51	0.11	6.4	--	7.8
wet (2)	8/23/79	0.77	1.30	0.59	19.2	0.30	25.4

SOILS AND VEGETATION

Range Condition	% Slope
67	6.0

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
71	11	13	5

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	53.5	61.0
Bare	25.5	20.5
NP Litter	13.0	11.5
Per Litter	8.0	7.0
Gravel	0.0	0.0

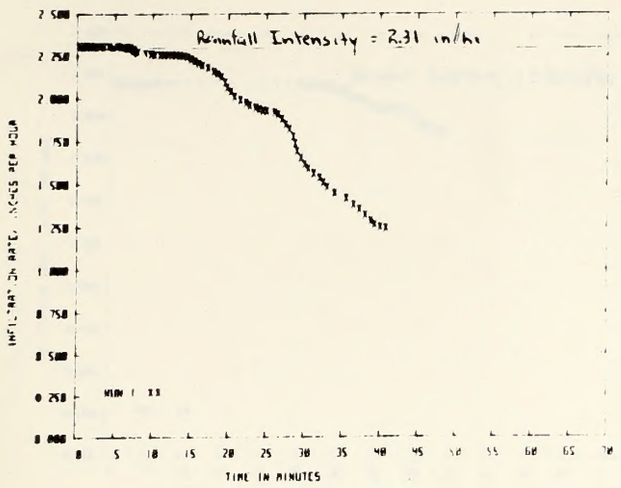
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Lichen	16.5	13.5
Bouteloua gracilis	17.0	19.0
Poa secunda	5.5	11.0
Carex	2.5	3.5
Selaginella	5.5	3.5
Arenaria franklinii	1.0	1.5
Agropyron smithii	3.5	5.5
Phlox	1.0	1.0
Opuntia	0.5	0.5
Stipa comata	0.5	0.5
All others	0.0	1.5

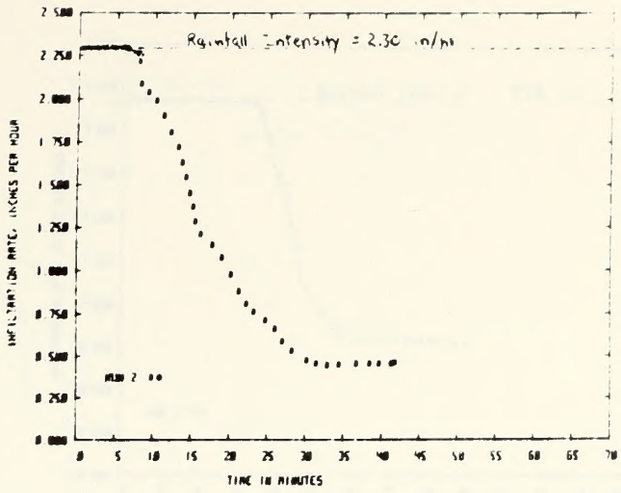
* Determined from first hit data using a point frame.

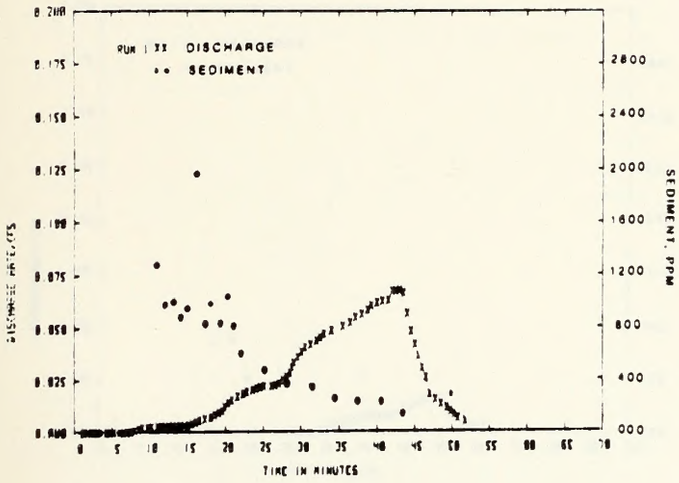
Montana Prairie Potholes Plot Number 11 Plot Size = 2546 ft^2

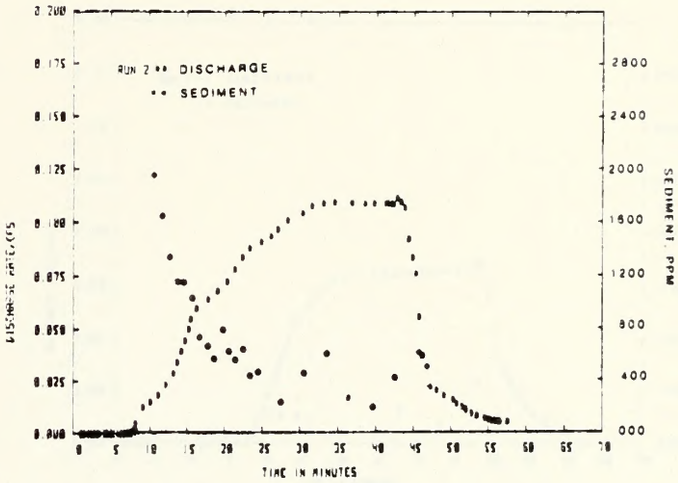
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	8/25/79	0.22	1.57	0.14	1.3	--	8.4
wet (2)	8/26/79	0.27	1.60	0.17	19.2	0.45	20.5

SOILS AND VEGETATION

Range Condition	% Slope
56	3.5

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
60	4	4	32

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	45.0	59.0
Bare	11.5	9.5
NP Litter	13.5	8.0
Per Litter	29.5	23.0
Gravel	0.5	0.5

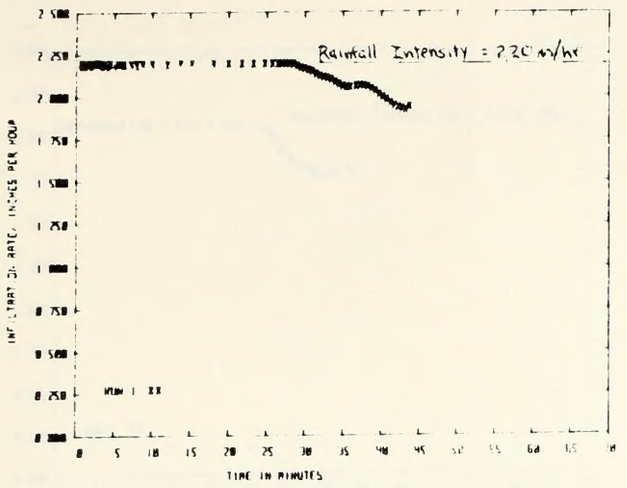
Species Composition

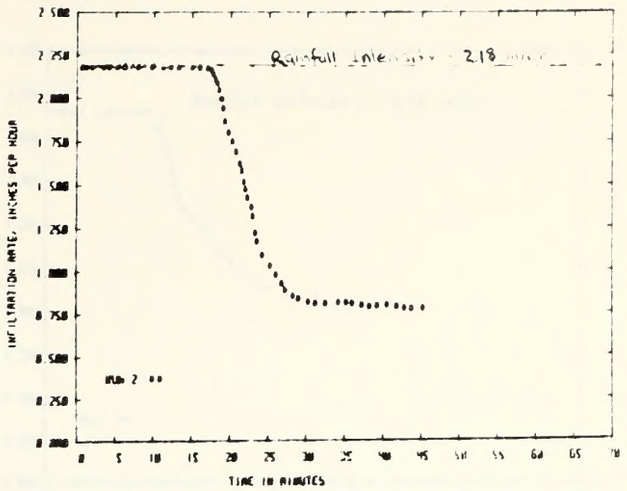
Species	% of Basal Cover	% of Canopy* Cover
Selaginella	16.0	12.0
Bouteloua gracilis	10.0	17.5
Moss	1.5	1.5
Lichen	9.5	7.0
Koeleria cristata	2.5	3.5
Poa secunda	2.0	5.0
Antennaria	0.5	0.5
Stipa comata	1.0	2.5
Phlox	0.5	1.5
Arenaria franklinii	1.5	1.5
All others	0.0	6.5

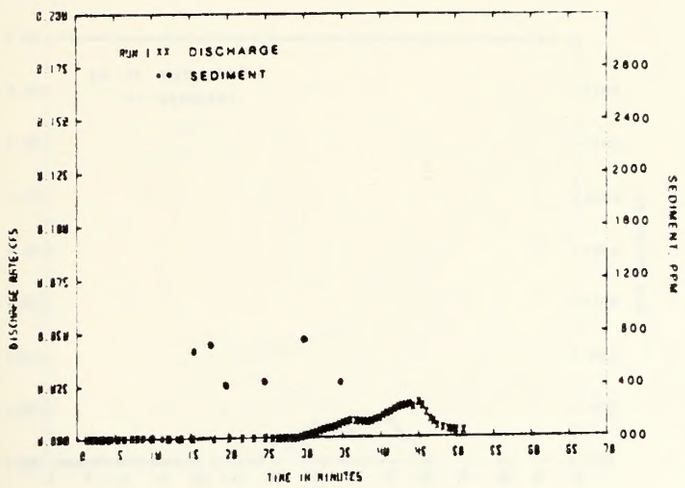
* Determined from first hit data using a point frame.

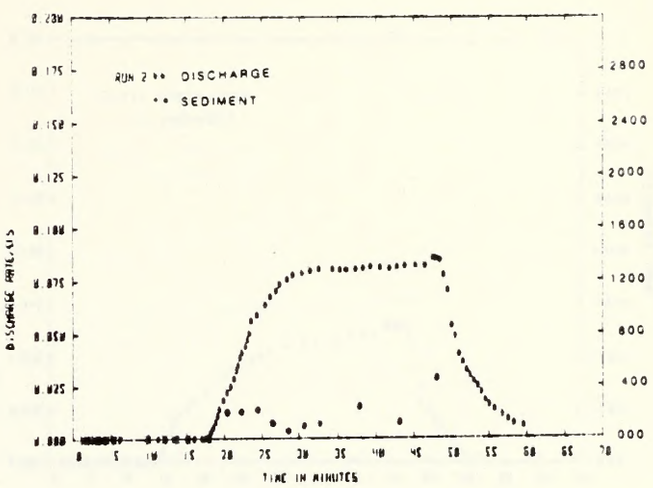
Montana Prairie Potholes Plot Number 12 Plot Size = 2531 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	8/27/79	0.02	1.61	0.01	1.9	--	7.6
wet (2)	8/28/79	0.55	1.69	0.33	--	0.75	23.3

SOILS AND VEGETATION

Range Condition	% Slope
65	2.0

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
28	44	0	28

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	58.5	73.5
Bare	4.0	2.5
NP Litter	6.5	5.0
Per Litter	31.0	19.0
Gravel	0.0	0.0

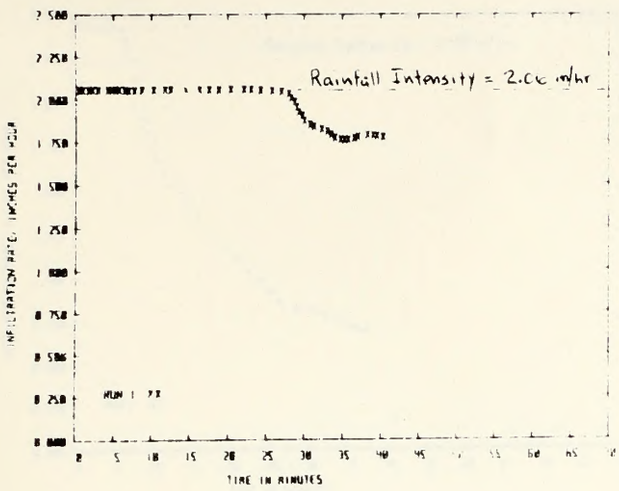
Species Composition

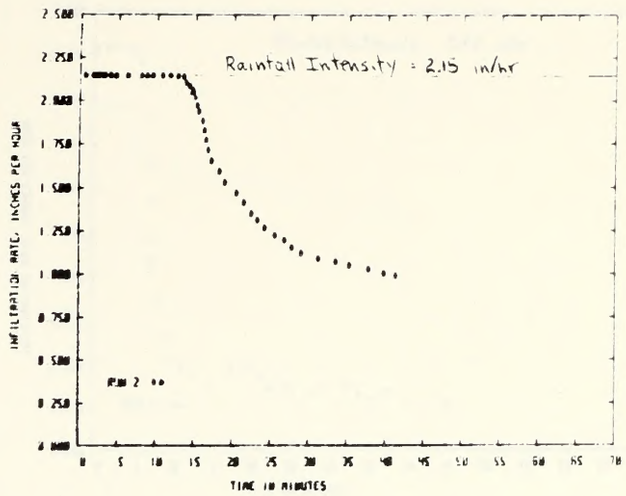
Species	% of Basal Cover	% of Canopy* Cover
Poa secunda	3.5	5.5
Selaginella	22.5	15.0
Bouteloua gracilis	20.0	23.5
Phlox	1.5	1.5
Arenaria franklinii	2.0	4.5
Unidentified forb perennial	1.5	2.5
Agropyron smithii	1.5	8.0
Stipa comata	4.0	7.5
Opuntia	1.0	1.0
Koeleria cristata	1.0	1.0
All others	0.0	3.5

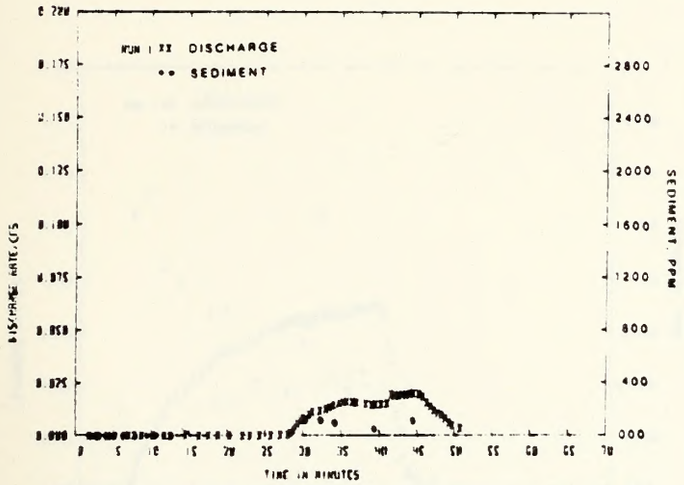
* Determined from first hit data using a point frame.

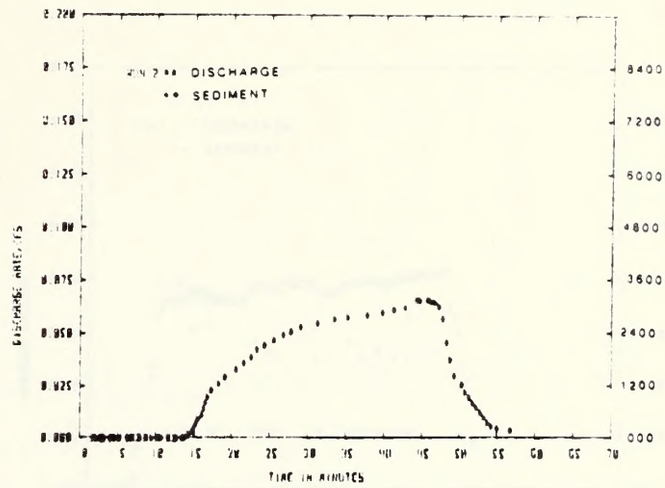
Montana Prairie Potholes Plot Number 13 Plot Size = 2305 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	8/29/79	0.04	1.40	0.03	--	1.75	7.9
wet (2)	8/29/79	0.38	1.53	0.25	2.6	--	15.4

SOILS AND VEGETATION

Range Condition	% Slope
37	5.0

Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
30	23	8	39

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	39.0	56.5
Bare	16.0	10.5
NP Litter	6.0	4.0
Per Litter	39.0	29.0
Gravel	0.0	0.0

Species Composition

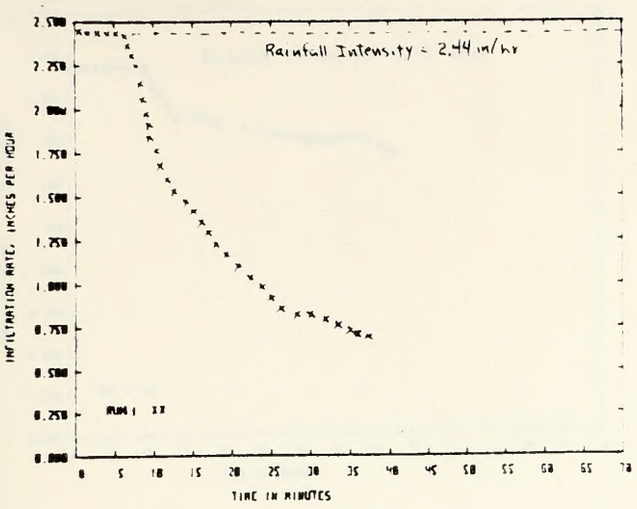
Species	% of Basal Cover	% of Canopy* Cover
Selaginella	12.5	10.0
Bouteloua gracilis	20.0	28.5
Poa secunda	4.0	8.5
Agropyron smithii	0.5	3.5
Opuntia	0.5	0.5
Carex	1.5	3.0
Stipa comata	0.0	2.0
Arenaria franklinii	0.0	0.5

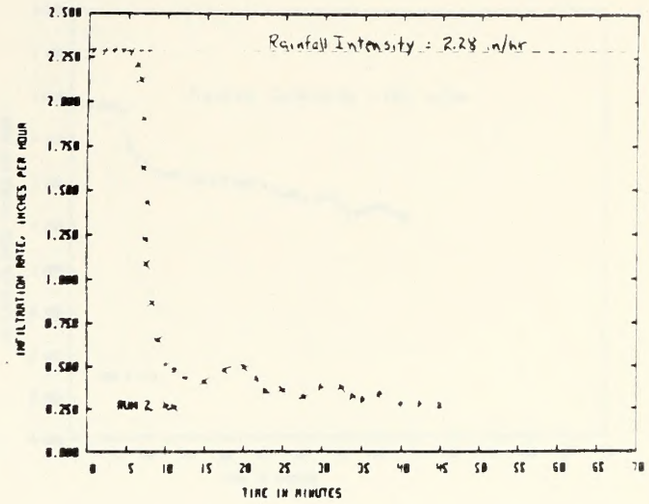
* Determined from first hit data using a point frame.

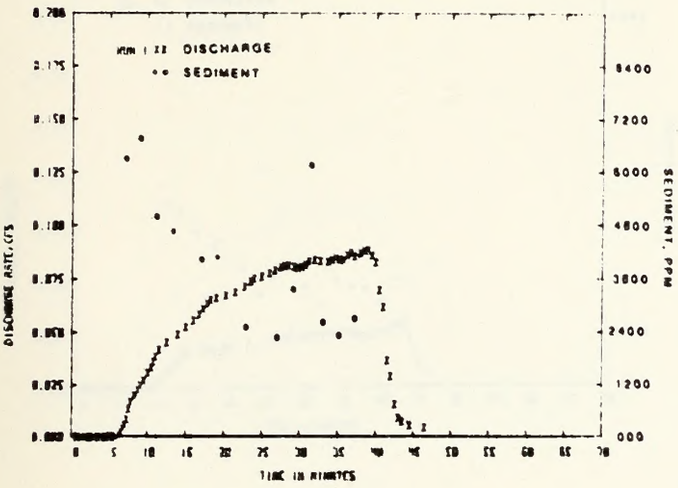
A-4

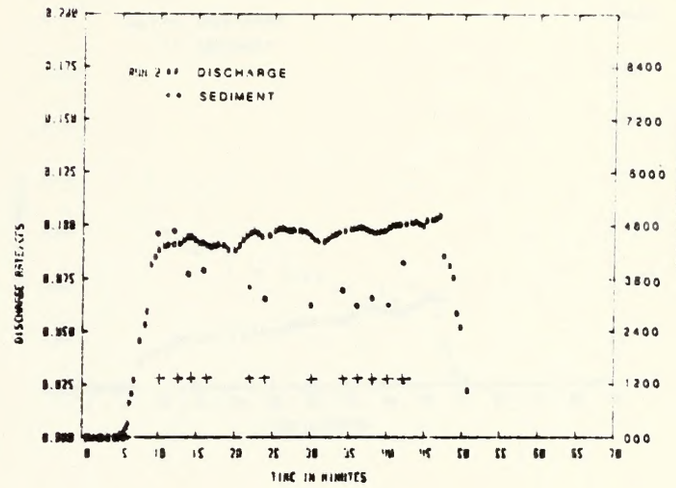
Montana Prairie Potholes Plot Number 14 Plot Size = 2154 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	9/20/79	0.62	1.50	0.41	102.4	0.70	9.1
wet (2)	9/20/79	0.57	1.69	0.34	166.4	0.27	18.2

SOILS AND VEGETATION

Range Condition	% Slope	Soil Series	Texture Class	Range Site
43	6.8	Dilts	clay	Shallow Clay

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	2.1	14.3
Bare	69.3	56.4
NP Litter	20.0	20.0
Per Litter	6.4	7.1
Gravel	2.1	2.1

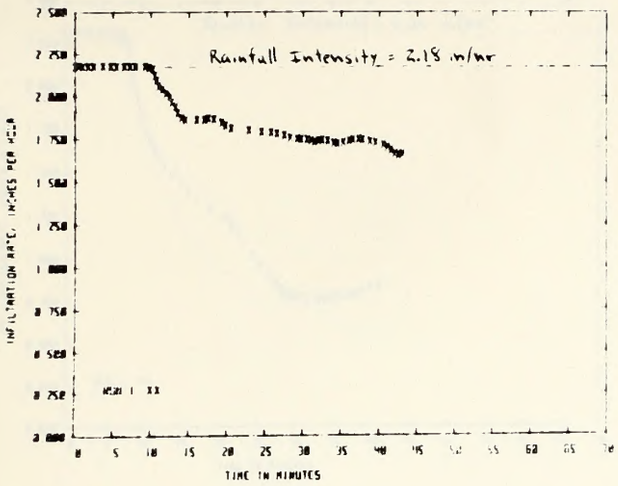
Species Composition

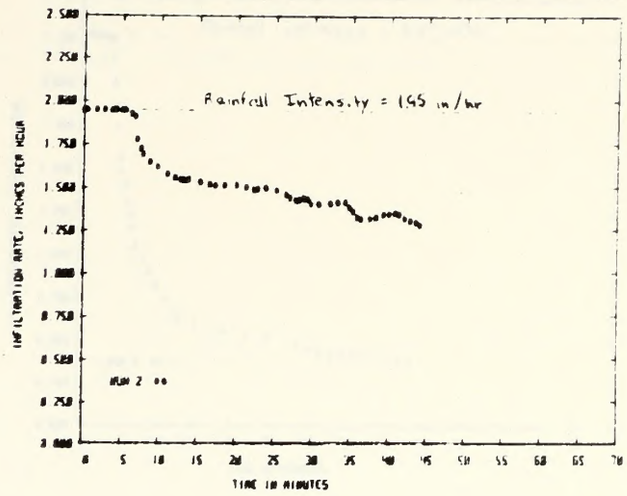
Species	% of Basal Cover	% of Canopy* Cover
Carex geophila	2.1	7.9
Rosa woodsii	0.0	2.9
Koeleria cristata	0.0	1.4
Calamovilfa longifolia	0.0	1.4
Unidentified forb annual	0.0	0.7

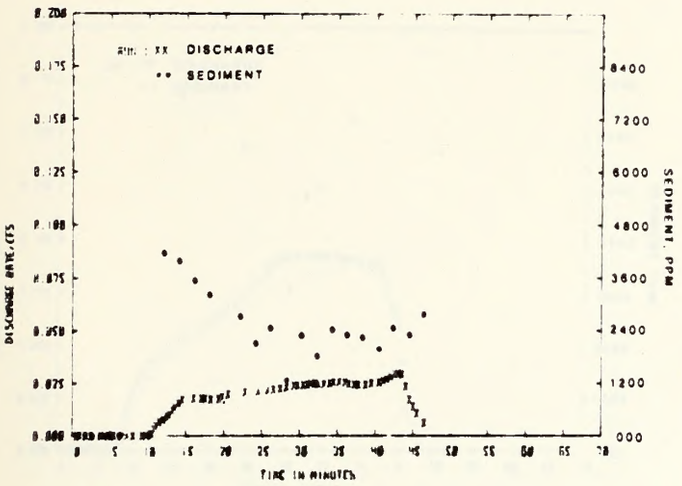
* Determined from first hit data using a point frame.

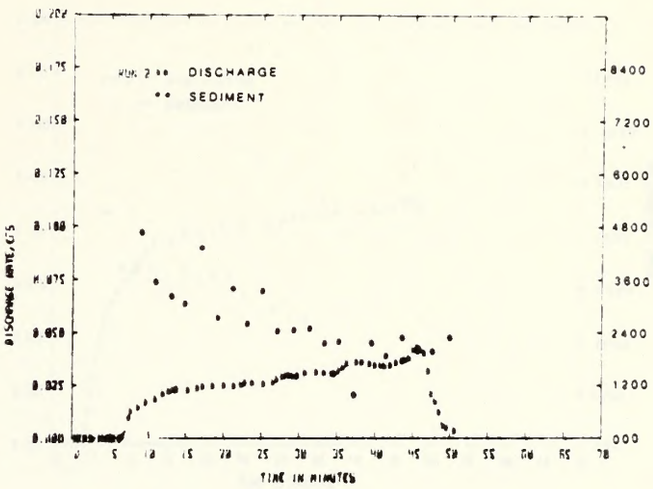
Montana Prairie Potholes Plot Number 15 Plot Size = 2463 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	9/21/79	0.11	1.56	0.07	38.4	1.70	17.0
wet (2)	9/22/79	0.18	1.43	0.13	64.0	1.30	23.8

SOILS AND VEGETATION

Range Condition	% Slope	Soil Series	Texture Class	Range Site
17	6.0	Dilts	clay	Shallow Clay

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	4.0	33.5
Bare	42.0	34.0
NP Litter	20.0	16.5
Per Litter	31.5	13.5
Gravel	2.5	2.5

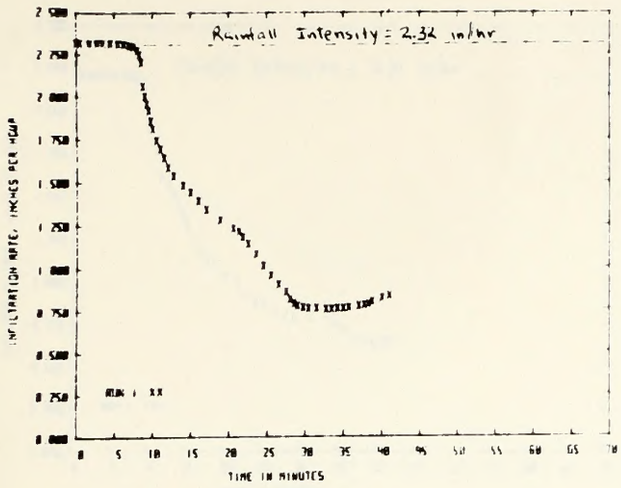
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Carex geophila	0.5	1.0
Juniperus horizontalis	2.5	30.5
Andropogon scoparius	0.5	1.0
Lichen	0.5	0.5
Calamovilfa longifolia	0.0	0.5

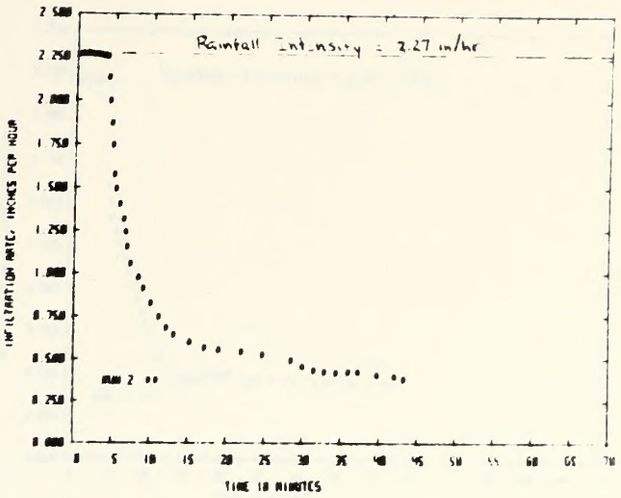
* Determined from first hit data using a point frame.

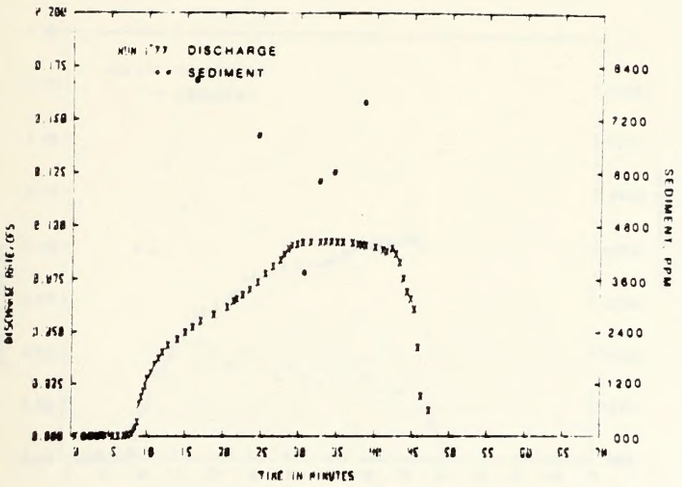
Montana Prairie Potholes Plot Number 16 Plot Size = 2567 ft^2

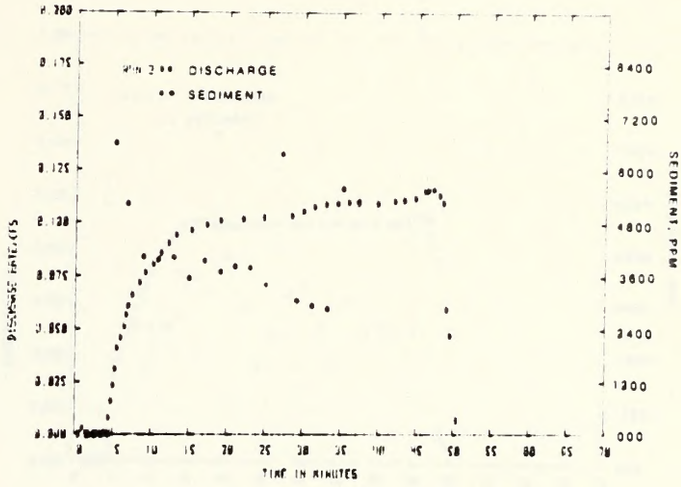
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	9/23/79	0.60	1.59	0.38	243.2	0.80	11.7
wet (2)	9/24/79	0.14	1.65	0.08	281.6	0.40	19.9

SOILS AND VEGETATION

Range Condition	% Slope	Soil Series	Texture Class	Range Site
39	6.5	Dilts	clay	Shallow Clay

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	0.5	12.5
Bare	74.0	65.5
NP Litter	16.5	16.0
Per Litter	8.5	5.5
Gravel	0.5	0.5

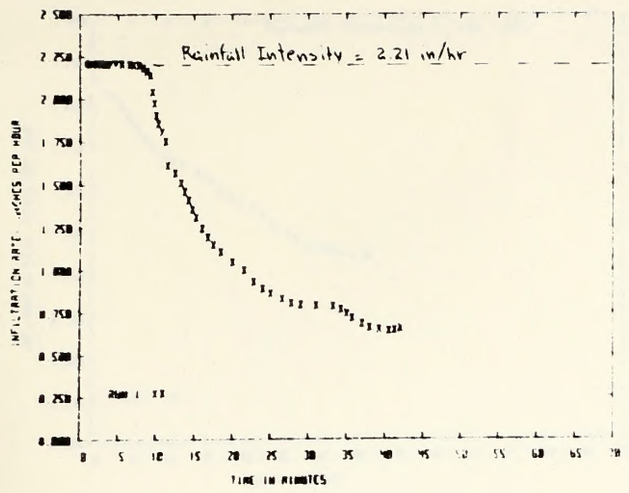
Species Composition

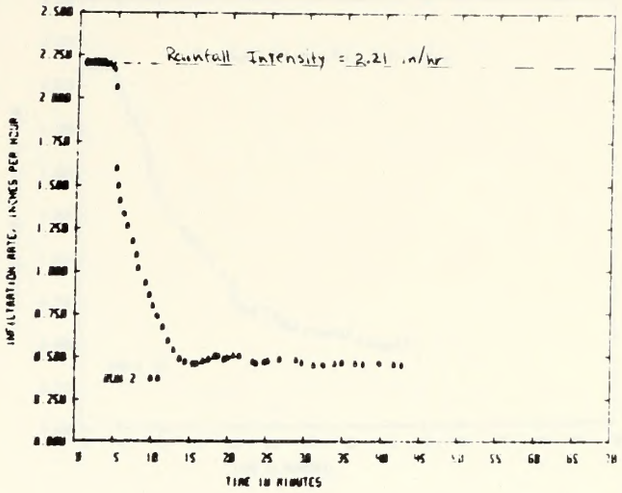
Species	% of Basal Cover	% of Canopy* Cover
Agropyron smithii	0.5	1.0
Juniperus horizontalis	0.0	8.0
Unidentified forb annual	0.0	1.5
Carex geophila	0.0	1.0
Calamovilfa longifolia	0.0	0.5
Andropogan scoparius	0.0	0.5

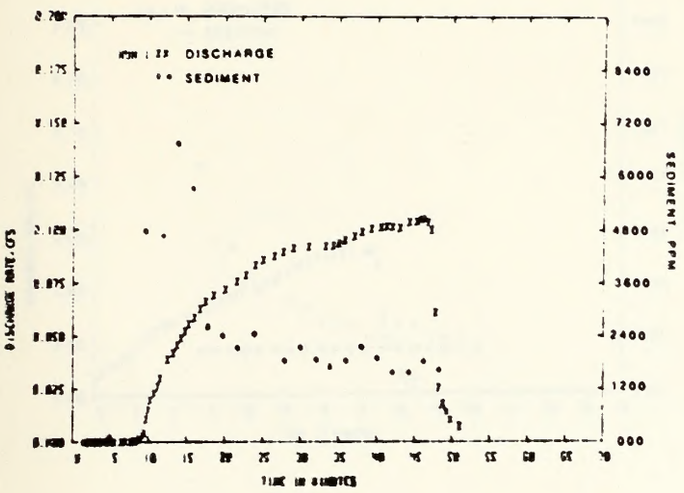
* Determined from first hit data using a point frame.

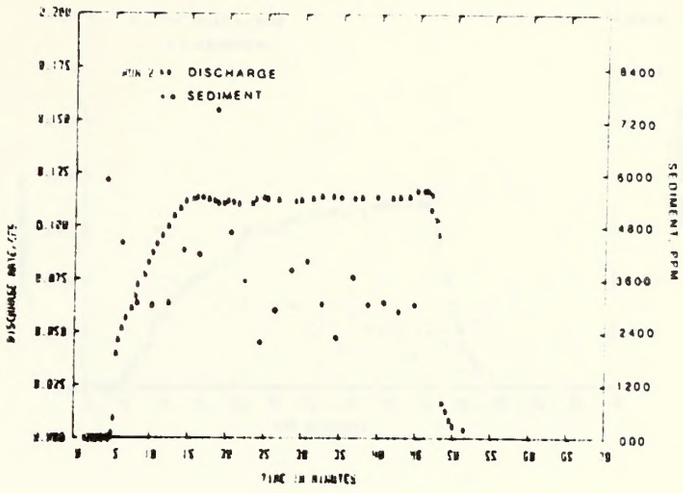
Montana Prairie Potholes Plot Number 17 Plot Size = 2811 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	9/25/79	0.43	1.57	0.27	134.4	0.65	10.5
wet (2)	9/26/79	0.10	1.58	0.06	294.4	0.45	19.6

SOILS AND VEGETATION

Range Condition	% Slope	Soil Series	Texture Class	Range Site
21	7.3	Dilts	clay	Shallow Clay

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	1.5	10.5
Bare	66.0	60.5
NP Litter	18.5	18.0
Per Litter	13.5	10.5
Gravel	0.5	0.5

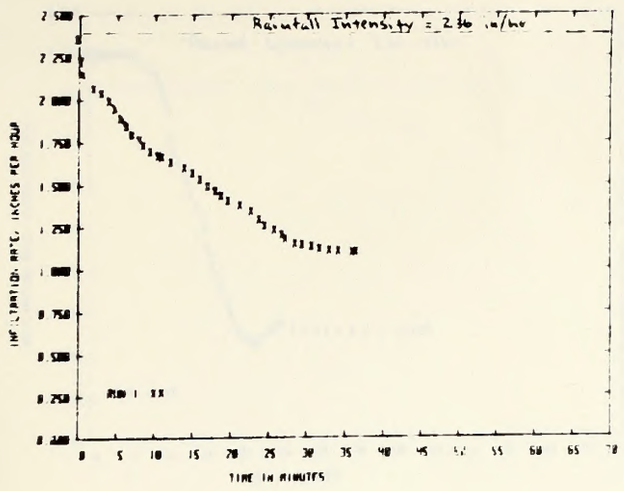
Species Composition

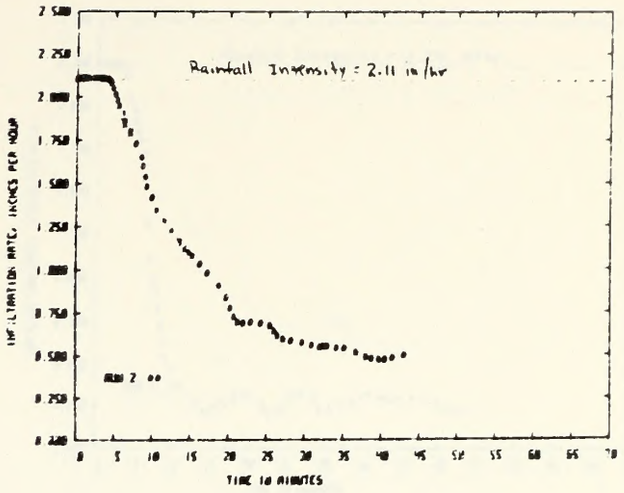
Species	% of Basal Cover	% of Canopy* Cover
Juniperus horizontalis	1.0	4.5
Carex geophila	0.5	4.0
Rosa woodsii	0.0	0.5
Andropogon scoparius	0.0	1.5

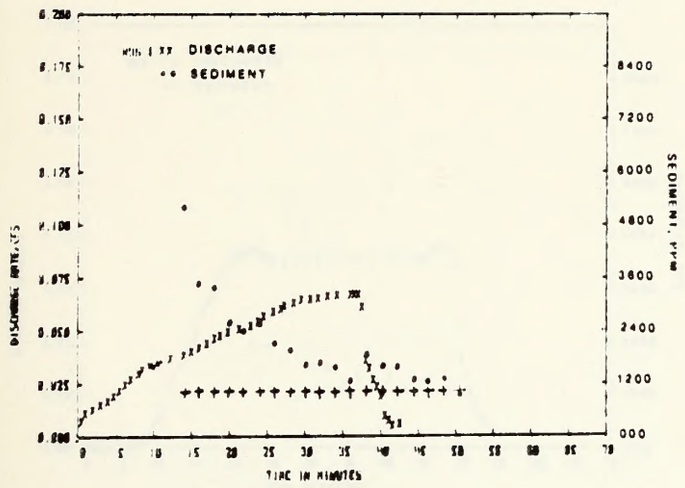
* Determined from first hit data using a point frame.

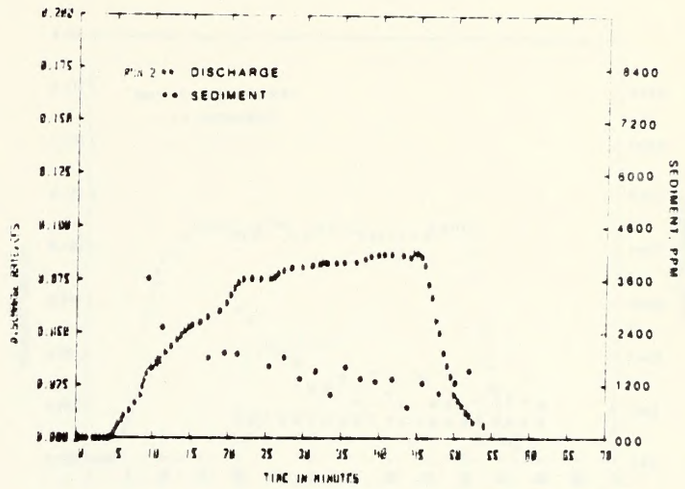
Montana Prairie Potholes Plot Number 18 Plot Size = 2303 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	10/17/79	0.38	1.62	0.23	51.2	1.10	8.8
wet (2)	10/18/79	0.75	1.53	0.49	44.8	0.50	16.5

SOILS AND VEGETATION

Range Condition	% Slope	Soil Series	Texture Class	Range Site
15	5.1	Julin	clay	Shallow Clay

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	15.8	43.1
Bare	59.8	44.0
NP Litter	13.9	9.1
Per Litter	10.5	3.8
Gravel	0.0	0.0

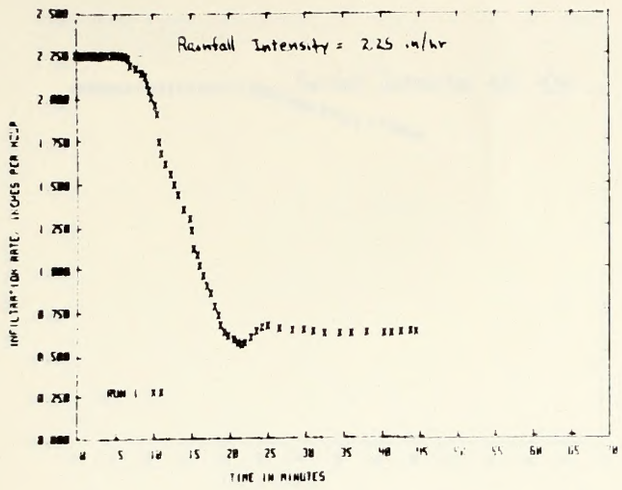
Species Composition

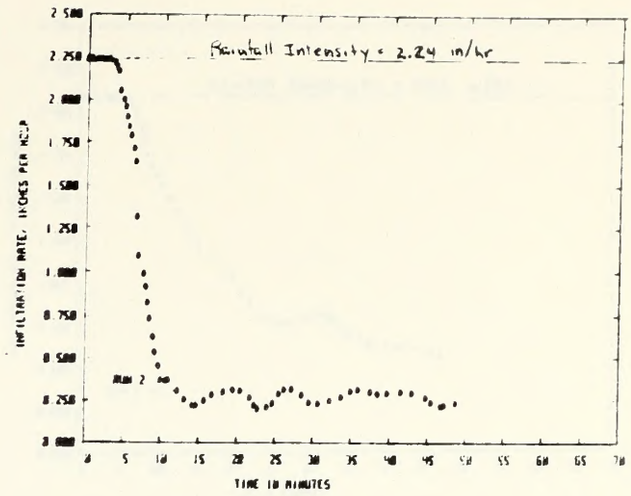
Species	% of Basal Cover	% of Canopy* Cover
Juniperus horizontalis	12.0	22.2
Carex geophila	3.3	18.2
Koeleria cristata	0.5	0.5
Andropogon scoparius	0.0	0.5
Calamagrostis montanensis	0.0	1.4

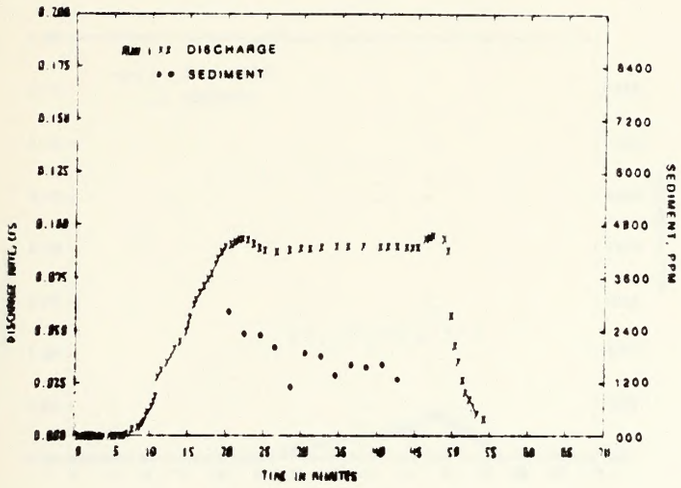
* Determined from first hit data using a point frame.

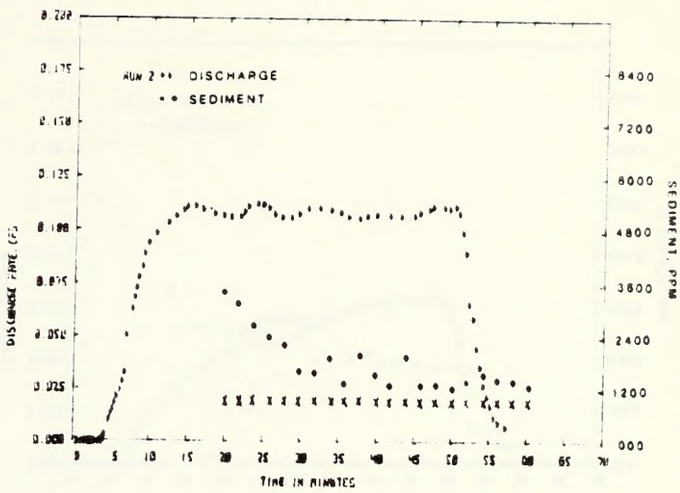
Montana Prairie Potholes Plot Number 19 Plot Size = 2386 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	10/19/79	0.86	1.69	0.51	51.2	0.65	10.8
wet (2)	10/21/79	0.09	1.84	0.05	76.8	0.25	20.4

SOILS AND VEGETATION

Range Condition	% Slope	Soil Series	Texture Class	Range Site
20	4.7	Dilts	clay	Shallow Clay

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	8.3	26.1
Bare	60.6	49.5
NP Litter	20.2	16.1
Per Litter	9.2	6.4
Gravel	1.8	1.8

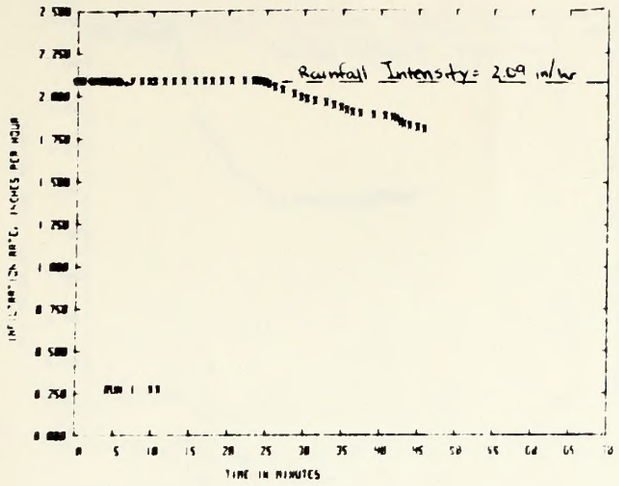
Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Calamagrostis rubescens	0.5	0.5
Carex geophila	1.8	8.2
Juniperus horizontalis	5.5	12.4
Calamagrostis montanensis	0.5	2.3
Andropogon scoparius	0.0	1.8
Rosa woodsii	0.0	0.5
Koeleria cristata	0.0	0.5

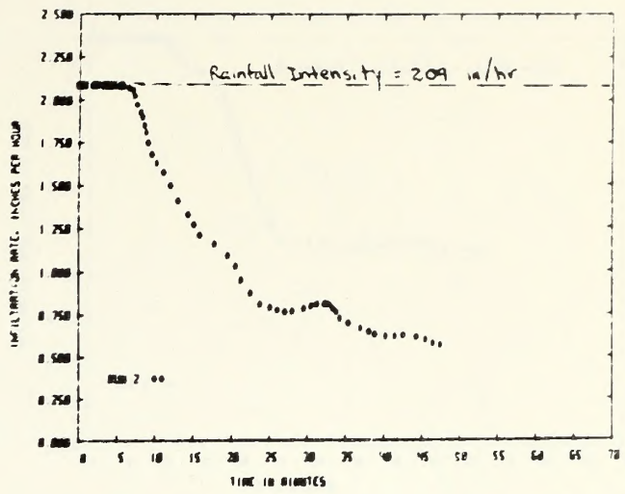
* Determined from first hit data using a point frame.

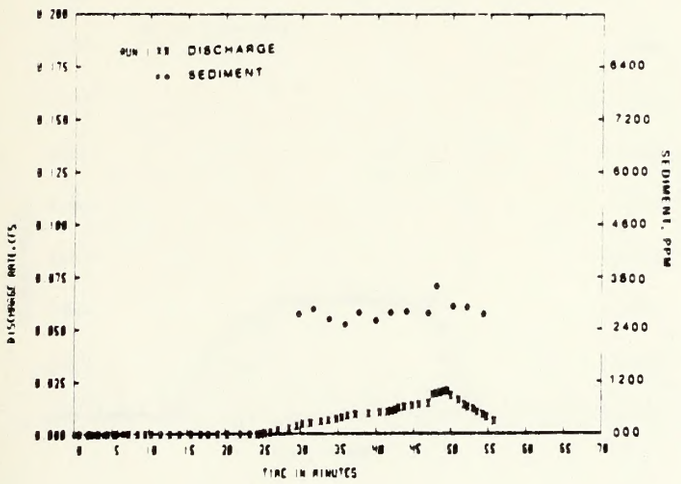
Montana Prairie Potholes Plot Number 20 Plot Size = 2264 ft^2

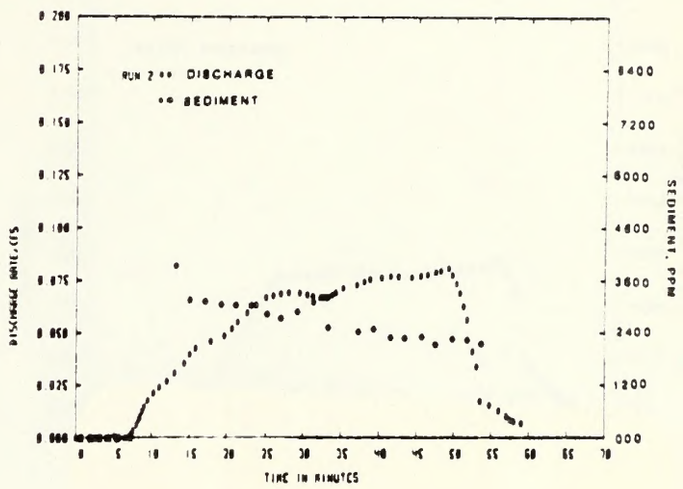
Dry



Wet







HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	10/22/79	0.04	1.62	0.02	19.2	0.00	15.3
wet (2)	10/23/79	0.67	1.68	0.40	83.2	0.55	29.7

SOILS AND VEGETATION

Range Condition	% Slope	Soil Series	Texture Class	Range Site
75	7.0	Dilts	clay	Shallow Clay

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	18.0	41.5
Bare	43.0	34.5
NP Litter	32.0	19.5
Per Litter	2.0	0.5
Gravel	5.0	4.0

Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Carex geophila	0.5	1.0
Unidentified forb perennial	1.0	2.0
Agropyron smithii	2.0	6.0
Andropogon scoparius	13.0	23.5
Rosa woodsii	0.5	1.0
Eriogodium	1.0	2.0
Calamovilfa longifolia	0.0	2.0
Calamagrostis montanensis	0.0	1.0
Sitanion hystrix	0.0	1.0
Melilotus officinalis	0.0	0.5
All others	0.0	1.5

* Determined from first hit data using a point frame.

Form 1279-3
(June 1984)

BORROWER

QC
926
.R34
1982

Rainfall simulation
Montana - prarie pot

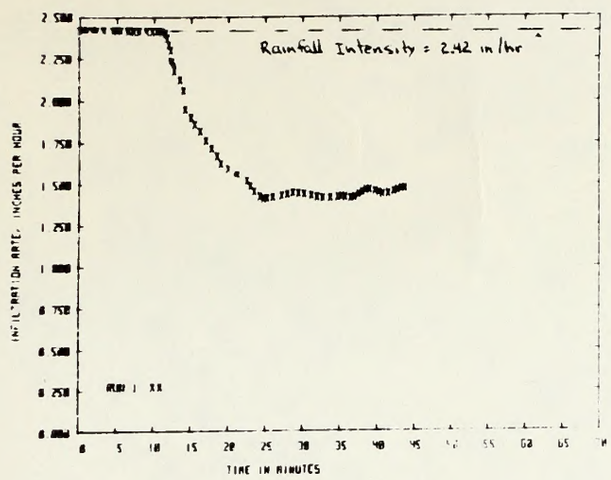
DATE LOANED	BORROWER

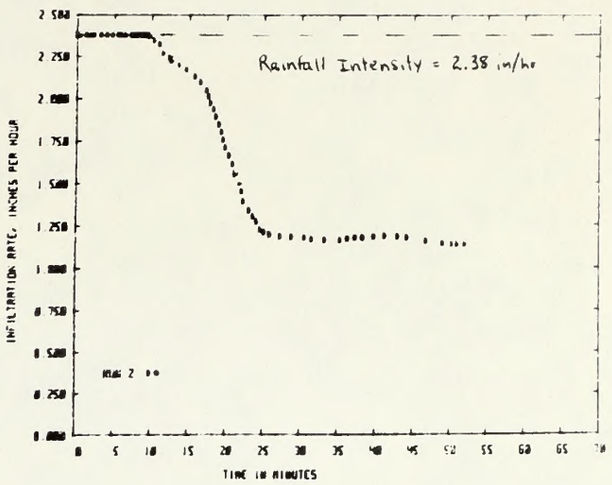
USDI – BLM

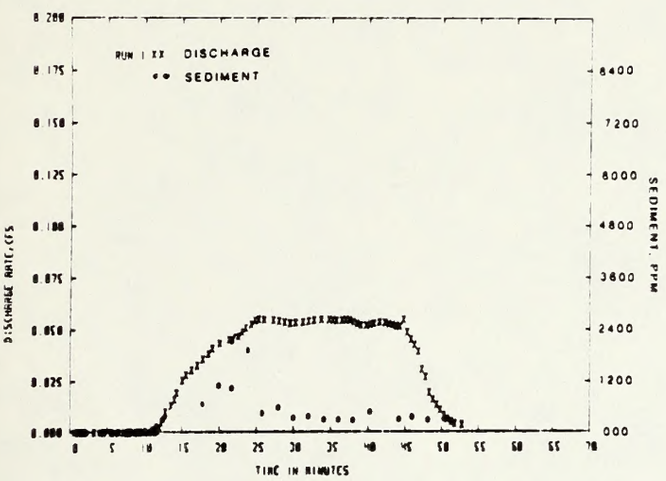
Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

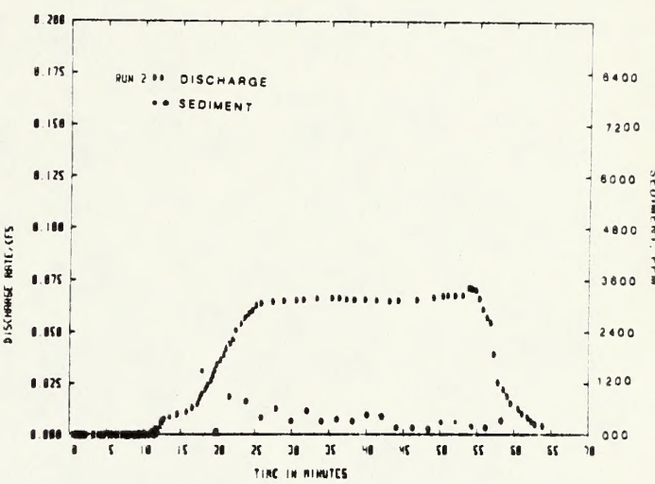
Montana Prairie Potholes Plot Number 21 Plot Size = 2362 ft^2

Dry Wet









HYDROLOGIC DATA

Run	Date	Total Q, in	Total P, in	Q/P	Sediment Yield tons/mi^2	Final Infiltration in/hr	Pre-run % Soil Moisture by weight
dry (1)	10/24/79	0.35	1.78	0.20	--	1.45	14.5
wet (2)	10/24/79	0.57	2.08	0.27	25.6	1.15	18.9

SOILS AND VEGETATION

Range Condition	% Slope
92	5.4

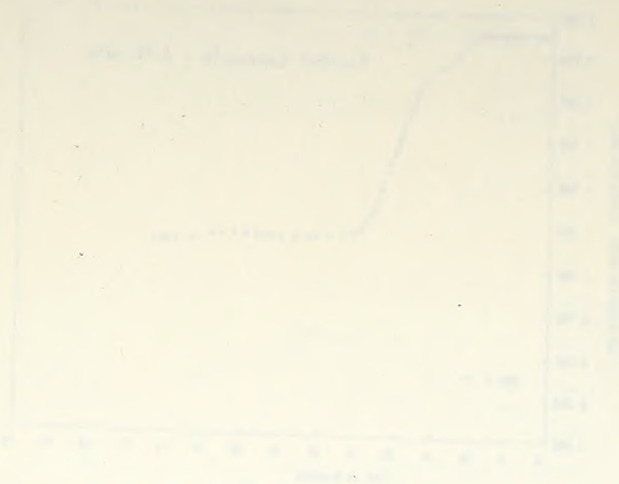
Soil Series - % Composition

Elloam	Phillips	Absher	Thoeny
30	45	2	23

Cover Characteristics

Cover	% Basal Cover	% Canopy* Cover
Vegetation	63.5	76.6
Bare	1.5	1.0
NP Litter	28.9	17.3
Per Litter	6.1	5.1
Gravel	0.0	0.0

Species Composition

Species	% of Basal Cover	% of Canopy* Cover
Bouteloua gracilis	3.1	6.1
Selaginella	46.2	26.9
Stipa comata	5.1	17.2
Agropyron smithii	5.1	15.2
Poa secunda	1.5	3.5
Arenaria franklinii	0.5	2.5
Koeleria cristata	1.5	2.5
Lichen	0.5	0.5
Plantago	0.0	0.5
Phlox	0.0	0.5
Eucalyptus largiflovens	0.0	1.0

* Determined from first hit data using a point frame.